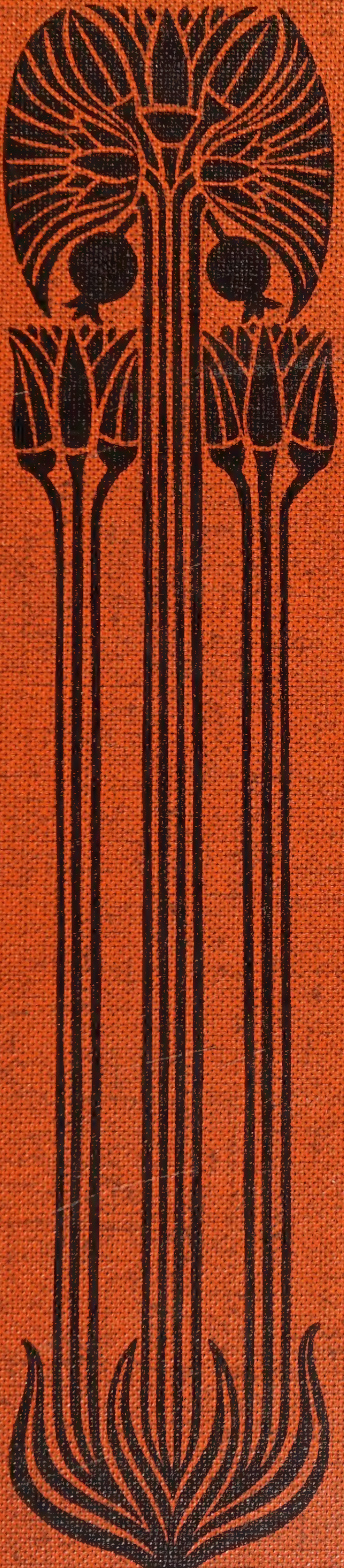

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GREEK MEDICINE
IN ROME

THE FITZPATRICK LECTURES ON THE
HISTORY OF MEDICINE DELIVERED AT
THE ROYAL COLLEGE OF PHYSICIANS
OF LONDON IN 1909–1910

WITH OTHER HISTORICAL ESSAYS

BY

THE RIGHT HON. SIR T. CLIFFORD ALLBUTT 1836-192
K.C.B., M.A., M.D., F.R.C.P., F.R.S., HON. F.R.C.P.I., HON. M.D., HON. LL.D.,
HON. D.C.L., HON. D.Sc., ETC., ETC.

REGIUS PROFESSOR OF PHYSIC IN THE UNIVERSITY OF CAMBRIDGE
FELLOW AND SOMETIME CLASSICAL SCHOLAR OF GONVILLE AND CAIUS COLLEGE

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TO

SIR NORMAN MOORE, BARONET

PRESIDENT OF THE ROYAL COLLEGE OF PHYSICIANS OF LONDON

BY

THE RIGHT HON. SIR CLIFFORD ALLBUTT, K.C.B.

REGIUS PROFESSOR OF PHYSIC IN THE UNIVERSITY OF CAMBRIDGE

Ἰατρικὴν οὐ δυνατόν ἐστι ταχὺ μαθεῖν διὰ τόδε ὅτι ἀδύνατόν ἐστι καθεστηκόν τι ἐν αὐτῷ σόφισμα γενέσθαι.—HIPPOCRATES, Περὶ τόπων iv.

PREFACE

It is not, I think, fully realised that, while the Roman Empire held the political supremacy, in almost all the higher ranges of the human mind Athens was still held supreme. As she lost her independence as a city state she won the place of a world university. Thus Rome, always the armoury of ritual, had to import her ideas; herself contributing to them almost nothing. Her ethical ideas she drew largely from Rhodes; and it was upon the Greek law that she built the noble superstructure which is her chief claim to immortality. During the Attic fashion in Rome, in the later Republic and the earlier Empire, certain gifted men did indeed assimilate and renew much of the best of Greek art and thought; even Virgil, the most consummate of them, owed almost his existence, in a literary sense, to Greece. And many others of Rome's greatest men, many who founded senatorial families, were of the provinces; and it was largely by letters that they built up and justified their eminence. As Greece stood for ideas without social order, the function of Rome on the contrary was static, the establishment of order without ideas; so that over her material body, as over a bridge, civilisation flowed into the West. In Augustan times poured into Southern Gaul not Hellenic and Christian ideas only but also unfiltered streams of the superstitions and grotesque imaginations of the farther East—thaumaturgy, sorcery, dreams, legends, pantheistic and other mysteries, secret rites, monkish asceticism, astrology, and so forth: *mox patuit breve confinium artis et falsi, veraque quam obscuris tegerentur.*[1] Furthermore, as we see among our own reactionaries to-day, exotic culture, at its best but half assimilated, bred archaisms, affectations, and artificial systems of dogma, ceremony, and sophistry. So the coarse simplicity of early Rome settled into the lust and corruption of the Empire, a change accelerated by the swarms of Greek parasites who battened on its impurities. Indeed amongst the several causes of the decline of the Empire this incapacity for ideas was not the least; Rome made for stability, but not for spiritual adventure.

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[1] Tac. *Ann.* iv. 58.

As with other faculties, so Medicine entered from Greece into Rome; but throve there only in so far as it was continually reinforced by the immigrations of Greek physicians. As the Greek oil failed the fitful light of the lamp went out. From Rome Medicine drew no strength; indeed in the Roman atmosphere, from Pliny to Isidore, scientific method and exactness of observation gradually died out. Even empiricism gained a new sterility. Notwithstanding, whatsoever its debts to Greece, Rome was the scene of a vast advance both intellectual and moral until, after Marcus Aurelius, the perils of barbarian invasion hardened that rule of "militarism" which, whether in the third or the twentieth century, casts a pall over the life of the spirit.

The lectures and essays in this book do not pretend to the place of original history; for historical research into the sources I have had neither the expertness nor the time. As a disciple I depend upon others; a gleaner where I have not sown. Moreover, partly of my own fault—for I lack the biographical touch of the President of our College—partly because of the meagre records of the ages with which I have to deal, my story is I fear too abstract to be generally interesting. I offer no curious or picturesque characters of men and manners. My great men are little more than signal rockets marking the weather of their periods. Yet I have found no pursuit more attractive than that of the sources, growths, and movements of ideas, and indeed their conflicts; for ideas enter the vulgar world at their peril! It is my hope then that the reader may find known materials so selected and compared as to refresh his interest in the story of the human mind. It is from this point of view that I have made large digressions in time and space, so as to link up the chains of thought from generation to generation. I would urge upon younger scholars our need of a history of Medicine written from this point of view, not from that of nations and tongues; just the pure form and growth of medical thought; for no ideas have been without their relative values, however transitory. And wasteful as the order of this world has been, devastating as the destruction of libraries and schools, ideas once conceived have rarely perished; for good or ill they have found foster-parents.

No doubt there is a temptation to make too much of ancient and inchoate notions; not only to interpret them in the light of modern opinions but also to remodel them on modern patterns, and to read into them notions then undiscernible. Against such colorable renderings we are well warned if not always well guarded; but we hear less of the converse error, one which has done injustice to our forefathers, the error of dissipating an ancient idea almost to evanescence by too vivid a use of the modern searchlight. Schultz has well said of the relics of the Ionians, as also of the arts of the fourteenth century, that at first they seem almost absurd; yet as we study them we begin to realise the value of their intent and content. Not at first explicit, they need precipitation from their solutions.

For action, and this is the function of mankind, some system of dogma has always been a necessary support; some scaffolding of an empirical philosophy must come before science. Things have to be done that will not wait. We have to outbuild our materials—gold, silver, precious stones, wood, hay, stubble—each perhaps having its provisional value. The Roman was above all things, a man of action; in Rome, even more than elsewhere, ideas became rigid or rhetorical, and outlived their spirit. Then came the inevitable recoil to the scepticism that was born in Greece and in Alexandria; but even the sceptics in their turn secreted a shell no less hard than that of any other sect. The problem of all time and of all people, a problem hitherto unsolved, has been to build doctrine just so far and so firmly as to give an instrument for social and rational purposes, but not so far as to harden into constraint. From a like point of view Dr. Edward Caird has written—that "systems of doctrine survive the most violent assaults, and even gain vigour from them; what they cannot stand against is being thoroughly understood and appreciated. Then the intelligence goes through and beyond them. The principle is extracted, and goes forth into new forms of life and thought wherein lie new mysteries to attract the spirit of discovery. History tells us that an idea arises, and a sect grows up to work it; but no sooner is the form established than a few minds, and then more and more, begin to run from under it, leaving the form to petrify."

Another interesting aspect of the history of ideas is the influence of one people upon another, as of Greece upon Italy through the gates of Cumae and Croton; or, in the sixteenth century, of Italy and France upon Great Britain. Dr. Rivers, in his FitzPatrick Lectures of 1917, said: "There stands out the vast importance of the contact of peoples, and the blending of their cultures, as a main, if not the chief source of progress"; although the inflow of a higher culture may, in the more backward people, be alloyed or debased. With the growing activities of Rome and of Mediterranean trade and travel, and with the diffusion of the Greek language, the traffic in ideas grew likewise, and increased with the foundation and influence of such schools as Athens, Alexandria, Smyrna, Pergamon, Marseilles; and, later of Toulouse, Salerno, Fulda, Chartres, Bordeaux.[1] On the other hand we find strange unacquaintances, aloofnesses, or gaps, where blends or percolations of culture might have been anticipated; as for example the neglect of the physical sciences in Athens, and afterwards in Ciceronian circles; as if all ideas were not for all climates. Still, in times of intellectual drought, rills from the well of truth soak or trickle underground to break forth in the plains; as mathematics, astronomy, and Galen's physiology, fountains from unknown subterranean channels, percolated through Rome, Magna Graecia, and the Arabs to the West—to Syria, to Salerno, to Fulda, to Ireland; wheresoever they broke forth there gleamed again the Greek spirit of search, of moderation, of reason, and of freedom. Lately, Dr. Singer[2] by a study of extant early South Italian documents supports an old theme of mine that in Magna Graecia a knowledge of greek was widely diffused down to the seventh and eighth centuries, that in the ninth and tenth it gathered together at the several centres, such as Monte Cassino and Salerno, and that in these lands much remains yet to be discovered. Dr. Singer indicates that "native Teutonic magic and medicine may be distinguished from imported elements of classical, ecclesiastical, or Salernitan origin by the presence of four marks—the doctrine of specific venoms, of the nines, of the worm as cause of disease, and lastly, of the elfshot."[1]

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[1] Greek medicine reached Gaul through Marseilles. It is narrated that one Crinas—under Nero—was a teaching physician in Marseilles. But Galen (K. xiv. 197) mentions a physician of Lyons earlier than Crinas, who made a large fortune by superior arts—I regret to say by astrology. Demosthenes the oculist was of Marseilles. Bordeaux had physicians in the fourth century A.D. as Helmreich says of Marcellus (p 384) who was a Bordeaux man. Marcellus handed down many Celtic plant names. The father of Ausonius was physician to Valentinian I., and his aunt Aemelia was a physician. But there was no organised system of medical education, unless by apprenticeship.

[2] "Early English Magic and Medicine," *British Academy*, 1920.

The ancient seer could express himself only by myth and symbol; myth was his mode of history; he had no store from experience and discovery wherewith to build up his thought, no analytic language for the expression of general ideas. It is in a new light that we admire the cosmogonies of those brilliant children, the Ionians, and, on another side, the vague but noble, gnomic, almost oracular prose diction of the elder Ionians—"Prophetenhaft" as Diels has called it—as of *The Epidemics*, the *Airs, Waters, and Places*, and the *Aphorisms*—reminding us of Aeschylus or Pindar. Once I compared medical history to the geological record; but I would rather compare its noble fragments to a basilica compiled of more ancient relics—of pillars, capitals, wrought stones, mosaic, gathered and built into a new edifice. We have thrust ancient myth and symbol too much aside, as wholly fanciful; we are discovering now that they are apparitions, luminous mists of truth—"its edges and its bordering lights," growing in form from one incarnation to another. So we distinguish between the fresh earnest spirit of the dawns of art and science when, as in ancient Greece or in Siena, ideas were striving for expression through imperfect means, and the stationary or decadent stages when, if the means may be better formulated, the spirit is enthralled in its own armour. *Καὶ τὰ μυθώδη δὲ οὐκ ἀλόγως σύγκειται.*

It is needless to say that the FitzPatrick Lectures, as here published, far exceed in bulk the Lectures as delivered; but by little the manuscripts then prepared. Many engagements, not the least of them during the years of war, prevented the revision and verification of their contents until now; and now in some respects they are belated. Foreign literature has been difficult to procure. In some parts it seemed necessary to alter the style of address proper to a lecture into a literary form; and attempts to prune away repetitions and overlaps, forgiven or even approved in a lecture, are only in part successful. It seemed necessary also to break up the lectures into chapters.

For the materials of the lecture on "Byzantine Medicine: the Finlayson Memorial Lecture," I am indebted to many sources. I had by me an old collection of notes and memoranda, derived partly from reading some of the authors discussed, partly from secondary sources. For early medical history, Haeser is, in my experience, still the backbone of study; but since his date much new work has been brought in, and particular epochs have been investigated with a fulness not consistent with the limits of his treatise. We are under like obligations to the histories of Puschmann and Neuburger: unfortunately Neuburger's history did not reach me till my own work was nearly complete. Dr. Withington's history, within the narrow limits he set for himself, is, if I may say so, admirable; and Dr. Fielding Garrison's more comprehensive volume has since filled a gap in English literature.

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[1] Disease of man or beast attributed to elves.

My debts to other historians I have indicated in the text and notes; I pretend to no bibliography. If in places I may have unwittingly adopted words or phrases from other writers and used them as my own—*si quando dormitans erravi*—may their owners forgive me. In my difficulties and ignorances I have had to thank such kind friends as Professor Henry Jackson, Sir John Sandys, Professor J. S. Reid, Mr. Bernard Cook and others for help of the best, always plenteously given. My only hesitation in this acknowledgment is lest I should throw upon my friendly allies any responsibility for my own shortcomings.

P.S.—One more apology: while this Preface was in my hands for revision I read the very interesting Address of the President of the Classical Association for the year 1920, in which the learned critic rebuked us for uplifting Greek letters at the expense of Roman. Mr. Warde Fowler's protest is timely, and comes in strength from one who has vindicated for Rome her birthright in imagination. In my pages, I fear, Mr. Fowler will see but evidence the more of that "conventional depreciation" of the Roman, in comparison with the Greek; yet I appeal for extenuation inasmuch as I have had to deal with a side of the Roman mind in which that great people was deficient. With Roman rhetoric, Roman virtue, and Roman love of nature I had not to deal.

C. A.

January 1st, 1921.

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CHAPTER I

PRIMITIVE ROMAN MEDICINE

Mr. President and Fellows—In calling me to deliver the FitzPatrick Lectures you have done me much honour; and it would be an ill-timed however genuine a diffidence which might seem to disparage your election; I may, notwithstanding, hesitate for a moment as I regard the dignity of this place, and admire the services of my predecessors. In them we have had examples of wide and sound learning, of biographical skill and of anecdotal charm, which are above my hope, and I trust outside your comparisons. For such lists I am unarmed. To original research I have no pretensions; I am a child in scholarship. Yet in some converse with letters my tastes, if not my talents, have attracted me to the development and propagation of ideas through the long and broken ways of history; and it is in the length and breadth of Roman History that we can knit up tradition into some continuity. Moreover, as the study of abstract ideas is thin and bloodless, I have attempted as far as possible to embody these ideas in persons; forms somewhat shadowy it is true, yet not wholly visionary. It will be my endeavour then to present to you a broad sketch, meagre and partial as it may be, of this evolution as illustrated in the history of Medicine in Rome.

Mr. Herbert Paul has said that "ancient Rome seems to us no farther off than the time of Queen Anne." The Middle Age, with its sacerdotal society, canon law, and peculiar scholastic philosophy, does seem more alien from us, in mind, imagination, and custom. With Roman Civil law, and humaner letters and philosophy, not to mention millionaires also and bureaucrats, we feel more at home.

On the dark and stupendous background of Rome, from the foundation of the City to this day, has been displayed, as on no other canvas, the procession of those forms and those forces, innate or acquired, of science, art, politics and religion, by whose conflict and interpenetration the peoples of modern Europe have been made, governed and inspired.

We have our moods in which we may ask ourselves if history is a fruitful study—nay, indeed, if this study be not a sign of an uncreative or even of a decadent society. If our hearts are opening more and more towards the promises of the future, why should we be hankering after pictures of the past? Did the Greeks of the Parthenon so regard the earlier temples whose fragments they built into their battlements, or did the Greeks of Sancta Sophia painfully restore the ruins of the Temple of Constantine? Did not the builders of St. Mark's, or of St. Paul's without the Walls, for their own creations demolish the monuments of the past, as the painters of the generation of Massacio obliterated the frescoes of their fathers, and as the scribe of the cloister buried the silver uncials of some rare pagan manuscript under his ruder record of the Gospels? Was it the wistfulness and pathos of a nation passing its prime which first tuned the notes of Virgil to a historical theme? Was his patriotism the pathetic clinging to a form which was passing away? And when our own poets take up the chant of *Où sont les neiges d'antan*, is the voice one of joy or of foreboding? In our saner judgement we shall answer with some boldness that the study of history need be no wistful turning back from the plough to yearn after golden ages which never were; that history is much more than the raw material for pieties, regrets, and picturesque instances. The study of history must become the orderly reflection and method of a society, past its golden childhood indeed, yet parting with this blessed blindness, to enter upon a nobler life, in the maturity of reason and responsibility. *Die Welt-Geschichte ist das Welt-Gericht.* To sap our ideals, as Roman history and all history show, does mean decadence; and it is for history to reveal the unity, the spirit, and the growth of all human ideals; and to maintain and advance their standards. Nay, may it not, as at the Renaissance which drank deep of the past, by a kind of psychical cross-fertilisation, sow in us the rudiments of a new epoch? It has been said that as an emotional and instinctive being man is dateless, but as a reasonable being that he is of yesterday. In its youth society is sustained by authority—by authority of king, priest, or philosopher; myth is then its history: but when authority ceases and self-government awakes historical reflection and comparison must begin. The society which had grown up on tradition, on its instincts as the cities of the bees and the rooks, must, if it is to interpret its own nature and to shape its future, now take to learn at first hand the origins, the course, and the principles of its growth, wealth, and activities; and moreover to apprehend the vast scale upon which material, and still more spiritual, forces operate. For time present can scarcely be said to exist: *Dum loquimur fugerit invida aetas*. From history, " a longitudinal section of human life," as Ilberg calls it, we shall apprehend how hideous is the waste in the phases of unreflective social development; and how progress may be made, not by scrapping one human society or devouring another, but on lines of continuity in free spaces of expansion, and by disengaging and delineating the methods by which a rational creates an economical evolution.[1]

Thus indeed it is that we are assured by our professorial colleagues that History is a Science; a truth of which we are made painfully aware when nowadays from the Capitoline Hill we look down upon the stonemason's yard still bearing the name of the Roman Forum. Science looks to the future, it is true; but to the more material future. It has little or no concern with values, but with means rather. Science seeks not exemplary instances; for science no fact is despicable because it is little or mean; true and false opinions are alike significant of the mind of the past. History is a science when by its methods we analyse our past; it becomes an art when for our inspiration we recreate the ideals which time had corrupted, and as politicians apply them to life. With the disengagement of reason there is no doubt, in society as in the individual, some loss of spontaneity; moreover the creative and the deliberative impulses, instead of uniting in fertile marriage, are but too apt at first to get in each other's way, to act at cross and even contrary purposes, and to mistrust each other; so that each faculty drags its images and counterfeits from the past to impose them upon its own times. We have been provided with static monuments of the past for admiration and example, rather than animated with the breath of its dynamics for life, strength and beauty. But the historical philosophy of an age gone by did not consist in its fashions and forms, nor in its ostensible systems of logic. Of course, no category which has been an instrument of thinking can ever become obsolete; but to imitate the past, as our modern medievalists would do, can be but a masque; in form and custom history never repeats herself: it is by a restoration of the motive and the spirit of the past that we must cherish the perpetual fire to kindle and renew the ever-changing forms which are never repeated. Man should ever be more and mightier than his past. It is then the mediatory office of such lectures as these to interpret the past *sub specie historiae*; to construct an historical or comparative criticism of life; to bring life and flexibility into law and logic; to warn us against the clumsiness of interpreting the ancients by translating our ideas and ways into theirs, as men have imputed Christianity to Virgil and Hamlet to Bacon, or as the earlier critics of the Bible, in the immaturity of the historical sense, occupied themselves with judicial criticisms of its contents: and, conversely, to warn us against the illusion of tricking out modern ideals in ancient trappings. From history we have to learn not only what our ancestors conceived, and made, but also why they thought and acted so. For if the world-drama is, in part, of man's conflicts with nature, it is far more a drama of his conflicts with his kind and with himself.

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[1] These paragraphs were written and the lecture delivered four years before the Great War began.

Again, both as science and art, both in reflective and developmental criticism and in regenerative idea, does not history make yet another kind of appeal to us? The mountaineer, familiar with a group of peaks as they had long appeared to him in his accustomed haunts, where again and again he had climbed their summits and explored their recesses, takes a new journey; he traverses a great valley, outflanks the hills, and suddenly from a strange vantage the once familiar peaks burst again into view; but with fresh features and in new relations. He gazes wondering at the transformation, as it were of some wary herd which, while he was making his circuit, had silently faced round to watch him, but yet seemed not the same. In some solemn maze they have wheeled about each other, and turned other looks toward the wanderer. Thus, I hope, in no extravagant figure, I may seek to convey to you the new, the strangely new, scene of the constructions of man when, by our adventures in history, we come round to see them from other quarters and other prospects. Our own group of ideas we knew; we had, if you please, scaled its summits and explored its recesses; but even these ideas now reveal themselves with fresh features and in new relations. And thus by comparison the real forms and organic plan of our own age are manifested to us as never they were before; and, whether as artists or geographers, we discover how partial was that knowledge, even of our own life, which before we had believed to be intimate and comprehensive. We do not know the full reality even of our own folk, our own walks, and our own phases of life until, by travel of time and space, we have outflanked them, and discovered their form and growth by other avenues and in other illuminations.

Now of medicine the history is, or until our own day has been, part of the history of natural science; and indeed in that conception of history which regards human societies as conditioned by material circumstances, Hippocrates preceded Comte, Buckle, and Taine. He therefore who would interpret the documents and the history of medicine must be at least initiated into all history. Physicians of the past, as of the present, were made of common humanity, and their life in medicine was not alien from their life, and the common life of their age, in love, work, and war. In the medical historian therefore the sympathy of humanity must be added to the accuracy of the scholar, and these to a technical equipment in our own art. In the age of Leonicenus, of Linacre, of Caius, of Fuchs, of Foesius, of Mercurialis, we made at the Renaissance a famous beginning. But the humanists, never very friendly to science, soon began to play us false. Disliking the raw anatomy of knowledge, with what they called "The Classics" they built a walled pleasaunce for themselves and dwelt therein, raising florist's blooms and cut flowers, till Wolfe and Schliemann began to throw stones over the fence. Too often they were of the kind of the old grammarian who said there could be no interest in a period when *ἀπό* governed the accusative.[1] In classical periods we realise our traditional ideals, but if they claim by stationary contemplation to govern development they stifle the spirit of history and the life of action, not only in forms of words and artificial categories, but also by an assumption of "common sense." Now "common sense" is no more than a balance of common knowledge, it never verified premisses, discovered origins, nor interpreted natural means, orders or ends. A curious instance of such a claim of common sense peeped out in a leading review of Mr. W. H. S. Jones's *Malaria and Greek History*; by this faculty the literary man supposed he could settle Mr. Jones's problem without even the pretence of repeating and verifying his researches. The study of language deals only with past experience—the past of the whole of mankind and of its chief persons, yet still of the past. New and enlarging experience is to be had not by common sense, but by new uses of the senses; and for the record of these fresh receptions, new words, new phrases, new combinations of old words will be required. Thus a nation, or an individual, which on advancing problems is not continually returning to the direct uses of its five senses may collect experiences, but makes none. No small part of the labours recorded in our "classical" journals may have a certain utility, but, intellectually and ideally regarded, seems to me to rank with chess problems. As too often studied only statically, literature is deprived of its quickening, and of those tests of affinity whereby we learn to discriminate the formal and incidental from the essential and spiritual.

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[1] This construction, I find, was not a mere pedantic pleasantry. Liddell and Scott indeed ignore it with severity; but in Sophokles I find many examples from Alexandrian and Byzantine Greek; for example, Porphyry, Hermas, Leo Grammaticus, etc.

Although then in the first ardour of the Renaissance medical texts were dragged into the light, some were printed, and Medicine received its place in the universities as a liberal study, yet humanist fastidiousness so prevailed that no original medical texts followed those of the sixteenth century; nor did eminent scholars and commentators labour much even upon these. Naturally therefore among the incunabula medical history settled on its lees; the baser utilities prevailed, and, in the eclipse of greek, latin texts were more in demand. Hence, beside the invaluable recovery of Celsus, sprang up a choking crop of Isagoges, Articellas, and crude latin renderings of portions of Hippocrates, Galen, Soranus, Rufus, and Oribasius, often derived through the, anything but achromatic, medium of syriac, arabian, or hebrew. Thus, as I have foreshadowed, forms were copied; but original works were driven out and the spirit—the touch with nature—was not imparted. The cruder stuff remained, the finer evaporated.

How hardly the quasi-sacerdotal crust of the false Aristotle and Galen was cracked and split up, I endeavoured in my Harveian Oration to illustrate.[1] And, even when by the sledge-hammers of Vesalius and Harvey this crust was cracked, the awakening was still slumberous. In my own reading for these lectures I have been surprised to discover the faults of the texts, the poverty of criticism, and the sequacious dependency of medical historians one upon another, even to verbal repetition. For the edition and interpretation of our documents, as I have hinted, and as Ilberg and Wellmann have declared, the too rare combination of physician and scholar—as in our own Adams, Greenhill, and Payne—is required. So it has been left to our time—I had almost said to our generation—to see the first great edition of a medical classic ; I scarcely need say that I refer to the Hippocrates of Littré, the first great modern work on the history of Medicine ; a work enriched as much by wisdom as by learning, and by textual revision in so far as the MS. resources of the National Library of Paris availed. These qualities come into more vivid relief when the work is compared with the great contemporary edition (*Acad. Sci. Amsterdam*) of Ermerins which, as likewise his Aretaeus and Soranus, are marred by editorial perversities. Daremberg, in his researches among the MSS., travelled more widely and set out a great design of work which unhappily was cut short by his premature death. However this learned and large-minded physician and philosopher achieved much. Besides many invaluable lectures and essays, he, and his pupils, produced the great editions of Oribasius, of Rufus, and of parts of Galen—such as Simon's edition of certain books of his Anatomy. But since then our progress has become still more lively. In greek we have had also Ideler's *Physici et Medici Graeci Minores*,[2] Wellmann's *Dioscorides*, Puschmann's *Alexander*. In latin again we have received three or four critical editions or commentaries of Celsus, and so forth.[3] To Diels, Ilberg, Wellmann, Sudhoff, and others we are largely indebted for the impulse to the re-editing of medical texts, and for the fertile culture, both linguistic and scientific, which they have brought to the task. I wish we could show in this country a like accomplishment. It is mainly, I believe, to Professor Diels, upon whom not long ago in Cambridge by bestowing an honorary degree we honoured ourselves, that we owe the vast project of a *Corpus Medicorum Graecorum*, from Hippocrates to Paul, now undertaken by the Berlin University under the auspices of the Associated Academies; a series initiated by the *Excerpta Vaticana* of Philumenos, edited by that distinguished and diligent scholar Max Wellmann. Still much indeed remains to be done in philology as well as in interpretation, as Usener and others point out; much also in comparisons with religions, politics, and manners. In exploration likewise, as in Greek, Egyptian and cuneiform records and inscriptions, hitherto rather disappointing, the future may have much in store. But after all our collections, probably after all we can hope to collect hereafter, the history of medicine will resemble the geological record in its breaches, in its fractions, in its faults, and in its embeddings of ancient and precious débris in later conglomerates. Cicero's conditions, "*excipiente memoria, prodendisque monumentis*" (*De div.* i. 6) are in our history too often wanting.

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[1] *Science and Medieval Thought*. By T. C. Allbutt, Harveian Oration, 1901. Cambridge : University Press.

[2] Ideler published this work in the last year of his life (1841–42) at the age of thirty-three. In him we had to lament a death even more premature than that of Daremberg.

[3] Another edition of Celsus is announced by the Saxon Society of Sciences under the care of F. Marx. There are rumours of the discovery of another and much earlier MS.

I have taken Rome as a vast dark background against which were projected the processions and conflicts of human ideas, as they gathered from east to west to pass before her, or through her, or to be taken into herself. It is necessary to my purpose then to see how this background was laid in; though in this place a survey of Roman origins must be so curt as bluntly to state for truths a set of opinions which, however probable, have as yet scarcely more than a provisional certitude. The original, the lowest, and still perhaps the thickest stratum of the peoples of the region I may briefly indicate as Mediterranean, was, and is, a small slender dark race, long-skulled, delicate in limb and feature, probably of neolithic descent, who buried their dead.[1] Moreover, as Sir William Ridgeway [2] has pointed out, there were in Rome the two forms of marriage, co-emption being of the plebs, two modes of disposal of the dead, and two calendars. Again, the aboriginal Latins, like other Ligurians, took descent through the mother, the Roman rulers through the father (cf. Virg. *Aen.* xi. 340-1). The Flamens and chief Gods—Janus, Mars, Quirinus—were all "Umbro-Sabellian."[1] This race was vivacious but not robust in body; not of large political capacity, more factious than warlike, more clannish than national; vain and fickle but attractive, sociable, affectionate, even tender, yet wily, and with strange red veins of cruelty; but above all endowed with imaginative or at any rate with artistic gifts beyond the rest of the children of men. In the great peninsulas and myriad islands of the inland sea, and no doubt over a much larger area, this race established civilisations of high culture, especially of artistic culture, which in its various modes, periods, and places was known to us under such names as Pelasgian, Minoan, Aegean, Ionian, Attic, and so forth.

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[1] Now in 1920 these views have gained much support and credence, as against Mommsen's view that patricians and plebs were divided only as rich and poor.

[2] *Camb. Univ. Reporter*, Dec. 5, 1916, p. 306.

Before and during the period which we may briefly call the Homeric the western and southern strands and promontories of Asia Minor were not Greek, but an outlying border of an inland power then strong enough to hold it against encroachment. Miletus was for the Greeks of that period a city of the "barbarously-speaking" Carians; although the Carians were experts in certain arts, yet they spoke a tongue unknown to the Achaeans. Mr. Hogarth thinks that the north-west corner of Asia Minor and Rhodes—Ialysus, Cameirus, etc.—were the first to become Greek. As the inland overlords—probably the "Hittites," Aryan invaders from the north, who were not a sea-going people—began to lose grip, and shrank away from the seaboard, the fitful migratory raids of the Aegean people became consolidated there into permanent colonies. How these colonies grew into the magnificent cities, the intellectual and artistic centres of Ionic Greece—centres which retained their vitality through many vicissitudes down to Byzantine times—it is not my part to narrate.

Now we are to suppose that northwards of this Mediterranean world there was an area of high pressure occupied by prolific races of alien stock, of greater physical strength and hardihood, of larger political aptitude, and perhaps sooner possessed of weapons of iron. These various kinds of northmen were fair of complexion, and on the whole bigger of body; less intellectual but in temper warlike, dominant, stubborn, and ruthless. In contrast to the earlier race they burned their dead, and thus in later days the two customs for a while continued side by side. We must presume that some period of time, probably a very long period, elapsed before, by their own increase or by the pressure of other races upon them, these fiercer northmen or mountaineers, as in the cases of Scythia, of Elam, and of Assyria, became restless ; pressure rose higher and higher, and the thrust southwards irresistible. Especially, as it concerns us at present, their periodical irruptions began and increased by way of the Balkans, where was a secondary centre of a rich bronze culture. Under the various names of Achaians, Thessalians, Dorians, Siculi, Umbrians, Samnites, Sabines (probably nearly akin to Umbrians), Oscans, and so forth, kindred tribes of warriors swept downwards on the peninsulas of Greece, Italy and Spain, slaughtering more or less, but for the most part subduing and enslaving the more slenderly built dark people probably enervated already by peace and indolence.[1] The later descent on Rome of a coalition of " Keltic " and other tribes under Brennus, lies more within common memory. " Gauls " and " Kelts," in one shape or another, were probably continual immigrants.

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[1] See also Ridgeway, "Who were the Romans?" *Proc. Brit. Acad.* vol. iii., a valuable paper I had not seen when I delivered these lectures.

Now it is important to remember that, although in the Greek peninsula the Dorians swept downwards to Sparta and the South, into the southern half of the Italian peninsula the northern tribes scarcely penetrated. From geographical causes this area was more open to occupation by way of the sea, and was thus invaded from Greece ; and the history of the flourishing harbours and cities of Southern Italy indicates that it was not malaria which at that time arrested or checked the immigration from the north, but the natural features of the land and coast. Southern Italy, in the times of which we are speaking—say from *c.* 570-280 B.C., when these cities submitted to Rome—was not Italian even in name, but in name was Magna Graecia, and in character Greek ; and this character, until blighted by malaria, it maintained. The Italiote Greeks held their general assembly at Heraclea ; the later Thurium was an outpost of Athenian influence. The people of this region were greatly reinforced moreover by the flight of kindred folk chased from Greece to " Saturnia " by the Dorians and their kind. Dr. Verrall spoke of the city of Naples, in the time of Augustus, as Hellenic in its society, culture, and festivals ; it became filiated to Rome late and reluctantly. Even in the twelfth century South Italy and Sicily were homes of culture when the rest of Europe lay under the cloud of barbarism. I have long held the belief that rivulets of this Greek blood and culture, however choked by oppression, disaster and pestilence, were yet one source of those springs of new culture which broke forth in this region in medieval times—of the inspiration, so various in its manifestations, of Paulinus, of St. Thomas, of the physicians of Salerno, of the savants of Naples, possibly of the Pisani ; and later of Telesio, Bruno, Campanella, Vico, and so on. Frederick the Second, by the library he collected, fed these springs, but he did not create them. Dr. James tells me he thinks that before that collection there were not a few Greek MSS. in Calabria. The natives of Calabria of A.D. 1155, says Gibbon, were still attached to the greek language and worship, and in medieval times regarded themselves as Greeks. I may note indeed that the first professor of greek in a Western university was a Calabrian ; Legrizio Pilato, at Florence, who pretended to be a Greek of Thessalonica. He is said to have translated Homer into latin for Petrarch. If I remember right he was forcibly described by Boccaccio as a dirty, grumbling little beast. He had the distinction however of being killed by lightning on board ship in the Adriatic. The archaeological spade work so much needed in Calabria will doubtless reveal hereafter in richer measure the distinctively Greek arts and ideas of this region ; and it will do more. Even to-day the Greek walls and tombs of the fourth century B.C. laid bare on the desolate waste of Metaponto read us not only the old homily of the mutability of human things, but the new and yet unlearned lesson that without Medicine there can be no abiding city.[1]

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[1] *Vide* paper by Mr. Stuart-Glennie (Meeting of American School in Rome, December, 1908) on a tomb of Pelasgic origin at Quinto Fiorentino (near Florence) which gives further evidence of a Pelasgic period between (as the author puts it) " the Ligurian and Etruscan epochs of Roman (Italian ?) history. If I do not enter into such vexed questions as of the round- and long-headed dark people of mid-Europe, and of Gael and Goidel, it will be readily forgiven me. The visitor to the Upper Engadine will have observed not a few of these dark people (Pelasgians ?) who had been driven up into the hills by conquering invaders. On the opening to women of factories in the West Riding, large numbers of these folk, quite typical individuals, descended from the hills to work beside the people that had once supplanted them. In marriage with the fair-haired northerners the children were often thrown remarkably distinct ; some small and dark, others big and fair ; blends being in the minority.

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[1] See also instance of Selinous and Empedocles, p. 101.

About the time of the foundation of Rome then a large under population of the slight dark people was submitted to the ascendancy of more vigorous northern tribes, of whom Umbrians and Sabines may perhaps be taken as types; though there is little evidence to prove that the invaders were Sabines. But this was not all. By way probably of the Po, and thence extending over the Apennines, a strong, a strange, and a gifted people, from whom the region of Etruria derived its name (Rasena in their own tongue), had in some foretime of history, perhaps about 1200 B.C., established themselves by fortified cities in northern and central Italy. As from this race, for good and for evil, Rome received much of its governing class and of its customs, we must digress for a moment to learn what we can of the obscure story of its origin and affinities. We shall consider hereafter the close connexion of Latin Medicine in its later history with Asia Minor, in the light of the story which the essay of Mr. Hogarth on Ionia and the East has set very ably before us.

To proceed after my summary fashion, we regard Asia Minor then as controlled by a great power whose history lies in the mists of the past, every key to whose language is lost, and indeed had disappeared in Strabo's time. This power—for we can scarcely indicate it less vaguely—was in its might continental rather than of the seaboard, and the seat of its power was in inland cities. It seems to have consisted in a lordship of Aryan invaders from the North, by way of the Black Sea, over native races which in ancient times, under the names of Carians, Lydians and the like, occupied the Levantine seaboard. Ancient records and modern researches indicate that what must have been a vast host of these people, Carians, or more probably Lydians, thrust out perhaps by the North Cappadocian overlords,[1] whether by sea, as may be supposed from their place of origin, the tradition of their advance from south to north, and their Italian history as sea-lords, "pirates," and great traders, or, as Mommsen supposed—less probably, *salva tamen eius laude*—by the Balkans and Aquileja, or by land from the north,—if so by the Brenner, the path of the later Cimbri—established themselves in Italy as

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[1] See also *Year's Work in Class. Studies*, 1916. It is not easy to suppose however with Mr. Hogarth that the Hittites did much to influence Hellenic development, either by transmitted Mesopotamian culture or their own. Unlike the Assyrians, they left no monuments of art or culture, and in any case seem to have abandoned the seaboard to the Western world.

Etruscans;[1] the Umbrians being, as Herodotus says, driven up into the Apennines.

The Etruscans brought with them not only some literature, some astronomical science, and a rich art, but also customs and ceremonies of such ascendancy and tenacity as to have entered deeply into the construction of ancient Roman society, and in no small part to have survived in the Roman hierarchy from then even till now: for the Roman Ceremonial, as we now see it, is not wholly, perhaps not chiefly, "Aryan." As, on the physical side, in their fleshy bodies ("Tuscus obesus," as the city Arab—"Moor"—becomes obese), almond eyes, big noses, and gorgeous tastes, so in their caste and stationary policy, customs, divinations,[2] magical and sepulchral ceremonies, dances, and festivals, this people was in character strongly oriental; their divinations may indeed have been witnessed by Abraham himself, on his entry into Hebron. Their trumpets are said to have been Lydian, their pipes Phrygian. Furthermore it has been argued that, as we see in certain several geological or botanical areas, the Etruscans, "Lydians," and the rest, were parcels of a relatively aboriginal Minoan stock, isolated by invasions and denudations. Neither in feature however nor in culture did they resemble the Pelasgians of Europe, "Tuscos Asia sibi vindicat" was the record of Seneca;[3] and they were not a subject but an ascendant people.

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[1] That ornaments and utensils like those of Etruscan provenance have been found in Rhaetia is true, as I observed under Professor Pigorini's kind instruction many years ago, at Matrai, Trent, and elsewhere. But all bronze civilisation was not Etruscan. Moreover, the Etruscans buried their dead; the Rhaetians, like all the Hallstadt and Villanova folk (Umbrian?), cremated. The Sabine families in Rome cremated. At Matrai bronze fibulae, coral, and amber have been found together, facts which I demonstrated in a Lecture to the Cambridge Antiquarian Society in 1892. Etruscan sway probably extended far beyond its realms, as, for instance, to the L. Benacus, the "Lydian Lake" of Catullus. The beauty and genius of their crafts are preserved for our admiration in all great museums, especially in the Vatican, in the Castellani, and in Florence; their work is described in Dennis's *Etruria* and later books. On the Lydian language, as not Indo-Germanic, see P. Giles, *Camb. Univ. Reporter*, Feb. 27, 1917.

[2] Divinations by entrails, flight of birds, etc., rather than by the astrology of the Chaldeans. Certain of the gods of ancient Rome were of Etruscan importation. It is surprising to see how long this grotesque divination by entrails survived, even among the upper classes; we find it still, with astrology, in the records of Posidonius—the πολυμαθέστατος. Tacitus says that the Germans practised augury and divination by lot. Mr. Barnard Cook remarked to me that for the Etruscan and so for the Roman augurs the left hand was the lucky side and the right the unlucky; not so for the common folk of Rome (Jevons, *Class. Rev.* 1896, x. 22). As to their route into Italy Mr. Hogarth tells me (1919) that there are no new facts; the sea route being the only way for which there is any evidence.

[3] In the Rhaetian Alps, where, as elsewhere in Switzerland, Etruscan utensils have been found, I have noted occasionally people of remarkable and peculiar aspect. In build they are tall and strong, the face long and large, with nose big but not very hooked—

Profoundly as the Etruscan differed from the Umbrian or Sabine Roman, especially in respect of artistic faculty, yet in warlike energy, military caste, doggedness, hard and exclusive temper, aristocratic supremacy, and curiously enough in the status of their women,[1] the two masterful races had so much in common that by their fusion Rome was created, and a permanent ascendancy established over the weaker but still multitudinous and no doubt somewhat mongrel people, or plebs, which we have regarded on the whole as aboriginal. Contemporary scholars who may be disposed to make ancient Rome mainly Etruscan are greatly overstating their case. On the other hand, we read of the "parcus Umber"—the close-fisted Umbrian; of the "tetrica et tristis Sabinorum disciplina"—the sombre and puritanical discipline of the Sabines, who were the backbone of old Rome.[2] The patricians and their flamens seem to have worshipped Sabine deities. In broad outline then the background of Rome, for us the soil on which Roman medicine was to be cultivated, consisted of the original small dark race, reduced to formal or virtual servitude, degraded but still vivacious and factious, and of an ascendant and irresistible aristocracy, mainly of northern invaders,[3] of different races and military power, but interpenetrated by another ruling race, of oriental

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rather a horse face, eyeslits not oblique but long and narrow, giving rather a sleepy expression, lips very thick; iris and hair brown, not black like the short dark folk of the same district; expression on the whole calm, stolid, or even heavy, not vivacious. I had not the audacity to propose head measurements to any of these persons; but I am told there is in the Balkans a broad-headed race from the East Adriatic, not Ligurian, who were early invaders of the primitive long-headed bronze people.

[1] In Greece the status of women seems to have varied much. We form our general notion from Athens, and later from a Romanised (Oriental) city such as Tarsus (Paul Ep.). We perceive also wide differences in Sparta, in Ionia (Sappho), among the Pythagoreans and so on. But, if Livy is to be believed, the Roman women, like the "Suffragettes," would occupy the approaches to the forum, and "lobby" Consuls, praetors and other officers. Two of the tribunes who opposed the repeal of the Oppian law were besieged in their houses. The women won, and the law was repealed. It was, again, a tradition in the Julian house that women should stand by their husbands' side in great affairs. Caesar, at the supreme crisis, refused to be separated from Cornelia. But Professor Buckland tells me it cannot be said of any known period that the status of women and men was equal in law, or anything like equal. *E.g.* in adulterium and stuprum the rules for the two sexes were not by any means the same (Dion. Hal. ii. 26. 6, Plut. *Rom.* 22).

[2] The "Lanuvinus ater atque dentatus" ("with fine teeth," as we gather from the context) was probably "Iberian" (Pelasgian). This passage (Catull. xxxix. 11 ff.) alludes to the practice of rinsing the teeth with urine; the whiter the teeth and the redder the gums the more of this disgusting lotion must have been used! Urine has not even yet wholly disappeared from the nursery pharmacopoeia; there are still crones among us who would use it, like "fasting spittle" for children's sores, and especially for chilblains.

[3] The women dyed their hair a light colour after the complexion of the ruling tribes; as later did the Venetian women.

habits. It is remarkable, and belongs perhaps to the military avocation of Rome, that while in religion the omens and auguries of the Etruscans persisted and even prevailed, their notable artistic qualities, unless in the mighty architecture[1] and cloacae, seem to have been stifled under military rigour, or, in later times, in luxury, until the Renaissance, when in Tuscany especially these qualities reappeared. In early times the Etruscans were warriors, hunters, pirates, and athletes; but we all remember the later description of them:

> Semper inertes
> Tyrrheni . . .;
> At non in Venerem segnes nocturnaque bella,
> Aut ubi curva choros indixit tibia Bacchi;
> Expectare dapes et plena pocula mensae
> Hic amor, hoc studium.
> *Aen.* xi. 732–9 (vid. et Catullus xxxix. 11).

Such was the people, a people rather stratified than blended, among whom Greek medicine, science and philosophy were rather suddenly introduced. The plebs which, had it been free, might have received such culture sympathetically, and developed it with understanding, possibly with genius, was deprived of education and initiative; the ruling classes were haughty, unreceptive, and incapable of comprehending the things of the mind. Where in Rome we find monuments or remains of scientific or artistic talent or genius, these are often of Gallic or Spanish origin. In architecture and sculpture the Greek influence was the chief and continuous inspiration.[2] As Lethaby said, even in Vitruvius architecture appears as a mystery, almost a magic, practised by the Greeks.

Whether in war, in religion, in literature, or in any high purpose of man, when forms are not kept fluid by an ardent and expanding spirit, induration and corruption set in. We have spoken of one of the lessons of history—that so long as we keep mind and passion free, forms will take care of themselves and be transformed in ever new revelations of beauty and strength. Thus of the so-called "Iberio-Ligurian" or Pelasgian people—names which signify kindred, if not identical races—the artistic and imaginative qualities, which in all the Aegean cities were notable and in Greece attained to incomparable achievement, in Rome seem to have been crushed under the weight of the State; even the melancholy harp of the oppressed seems to have been muffled or broken. Yet, such were the undying gifts of this brilliant race to an ungrateful world, that wherever they broke forth again into some freedom, in realms—as in Gaul and in Spain—where the fury of the northern invaders was appeased; or in remoter fastnesses such as Brittany, Wales, and Ireland, where they were, so to speak, squeezed out at the edges of the conquering principalities, their song was heard again; no longer indeed joyous, dominant, supreme, but wistful and symbolic, dreamy, and unsubstantial in the sense of uncondensed mystery rather than of chaos; yet, as in the Ireland of the eleventh century, soaring again; in Alfred and Charlemagne educating kings and dynasties, and in France, in Belgium, in Franconia, in Switzerland, in North Italy (Bobbio) teaching and illuminating the new Europe; so that to these remnants in the west, as to Greece, may the old phrase be adapted [1]—"*capta ferum victorem cepit, et artes Intulit agresti.*" Their creative work, like that of the Jews, if it has not gone to the making of nations, has helped to build up the spiritual kingdoms of mankind. It is often said that the decline of Rome was due to its foundation on slavery; there is some truth in this if the subjection of the under race be included in the words.

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[1] It is said that the great temple of Jupiter on the Capitol was of Etruscan architecture; great examples of it, in enormous city walls, uncemented but everlasting, in the arch with uncemented keystone, and in exquisite specimens of jewellers' work, are well known to all travellers interested in ancient history. The Roman house is supposed to be on the Etruscan plan. [Such was my view of the subject when these lectures were delivered; it is hardly my opinion now. The great cloaca, so confidently attributed, like the arches of Perugia and Volterra, to the Etruscan masons, if built on the old models, is probably of the late Republican period. In any case the discoveries at Cnossus have greatly changed our conceptions of the dates and origins of early Mediterranean architecture and fine art.]

[2] See Mrs. Strong's *Roman Sculpture*; though I think in portrait-busts we observe a strength and individual character born somehow in Rome.

And of this race, not as the artificially degraded plebs of Rome but as the spiritually free, if politically subordinate, Pelasgic Ionians of Greece and Asia Minor, we shall have to speak as protagonists of Medicine in the arena of Rome; Rome as we have seen her grow up—austere, masterful not in ideas but in material predominance; yet, being ignorant and infused with some Oriental affinities, superstitious, and in religion ritualistic and pharisaic; a people entrenched also in a folk-lore and a folk-medicine of their own, and worshipping a mob of pallid chthonic and animistic (see *e.g.* in its higher development, Virg. *Aen.* vi.) deities, each, as elsewhere so in Medicine, personating rather than creating not only every chief system and function of the body but every stage of each.[1] For each stage of labour there was its peculiar deity; and of limbs even the harmless, unnecessary navel had its divine warden. Nay, after birth also for every period of life there was a god; a god unloving and unloved. Thus, as Bloch says in Pagel's *Handbook*, "the religious cult of Rome contained an entire pathological system"—and they consecrated every detail of it. Mommsen also had said that this religion signified every function of life. Even the itch was not without its goddess. Thus for the early and religious Roman a scientific medicine was impossible. How in the decay of faith, and by the immigration of the busy curious Greek, this "cake of custom" was broken up we shall have presently to consider. Soranus bluntly declared that the obstetrician should be "ἀδεισιδαίμων," no believer in spirits. It were scarcely worth while for the purpose of these lectures, even had I the mythological knowledge, to distinguish, in the chthonian and olympian hierarchies, between the gods of the Etruscans and those, on the one hand, of the aborigines, and, on the other, of the northern invaders. Into the populous circles of Graeco-Roman divinity almost any new god was welcome who could be made to play a part in the old company. The Etruscan worship was however, in the main, nature worship, and its deities chiefly chthonian. Among all the aboriginal Mediterranean races the chief deity was, and still is, the great and fertile Earth Goddess—Dea dia, under various names—Cybele, Rhea, Ashtoreth, Diana, Orthia of the Spartans, Artemis of the Ephesians, and so on. In his rare hymn to Diana, Catullus, after saluting her as the mistress of woods and fountains, as Luna, as Trivia, as the patroness of corn and fruits, and as *Tu Lucina dolentibus Iuno dicta puerperis*, exclaims:

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[1] To speak of "wedding the Celtic vivacity to Greek technique," unless in certain late and special instances when Greek had dried into a "technique," seems to me, at least ethnologically speaking, a misapprehension.

> Sis quocumque tibi placet
> Sancta nomine, Romulique
> Antiquam, ut solita es, bona
> Sospites ope gentem.
>
> Catull. *Carmen Sec. ad Dianam.*

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[1] "Utique nostra regio tam praesentibus plena est numinibus ut facilius possis deum quam hominem invenire" (Petr. *Sat.* xvii.).

And, as Mr. Hogarth points out, from the General Council of A.D. 431 when the Nestorians were condemned, the Madonna had taken this place in the hearts of the people, and, both in the Roman and the Eastern Church, has held it ever since. Let me here remind you of a passage in the first volume of the *Stones of Venice*: "The Madonna is in great glory, enthroned above ten or dozen large red casks of three-year-old vintage, and flanked by goodly ranks of bottles of Maraschino and two crimson lamps . . . in the evening, when the gondoliers come to drink under her auspices, she will have a whole chandelier."

We cannot wonder that the Solemn City, the seat of rulers so grave and haughty, mistrusted and repulsed the plausible and versatile but more alert and intellectual Greek, and had not yet realised her need of him. When Greece was at its height Rome was the land of the soldier, the peasant, and the small trader; a people without art, without literature, and without philosophy. It has been aptly said that the relative geographies of the two peninsulas, Greece and Italy (for the elder Greeks the land of Hesperia), especially in respect of harbours and seafaring, were such that they turned their backs upon each other; the mission of Rome was westward. Until the third century, except at Cumae founded very early by "Pelasgians" from Euboea, and a little later at the remoter Ancona—the one fair harbour on the Adriatic aspect, the intercourse of Greeks with Rome, if any, was mainly by the southern provinces. It was not until four centuries after the time when Rome was little more than a dyke and a palisade commanding an agricultural domain that she established diplomatic intercourse with Greece,[1] and that a Greek freedman of Tarentum became the earliest of Latin poets. After Metapontum, Tarentum, a great city upon a rock, founded by Dorians of Lacedaemon in 708 B.C., produced between 400 and 330 B.C. its finest coins, and led the southern confederacy until its reduction by Rome in 272 B.C.

So far then as we have glanced at the scene and sources of Medicine in Rome, we discover a broad and deep but far from pellucid stream issuing from and compounded of the folk-lore of the small dark old Italian people we have taken as aboriginal, of the oriental Etruscans, and of invading northern tribes whom we may indicate roughly as Thessalian. These northern tribes, which had then an art and policy of their own as we know they had still in later times, if somewhat overlapped by Bronze culture, were untouched by the southern civilisation; although the Minoan Cretans were but two hundred miles away. The penetration was at first from southward, by the sea-going Aegeans. As it is obviously impossible for us now, were it worth while, to trace Roman folk-lore farther and severally upward to these three constituent founts, we must content ourselves with some note of its characters as we find them in respect of medicine when Greek physicians first appeared in Rome.

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[1] The well-remembered embassy of Diogenes, Critolaos, and Carneades to the Roman Senate praying for the reduction of an indemnity, as at Spa in 1920. The decree of expulsion of the "philosophers," a few years previously, must be taken as a sign that Greek ideas were then spreading to Rome.

Into that main stream of more or less universal primitive folk-medicine were now poured three fresh tributaries, all of them the expressions of a far higher culture: the two first of these tributaries were branches of the medicine of the Greek clinical, or Hippocratean school; the older of the two of Italo-Greek origin, dating from the sixth century, and deriving, as we shall see, through the disciples of Pythagoras, Alcmaeon, Empedocles, in Sicily and at Achaean Croton, a school second only to Cos, and at Metapontum;[1] the later from the school of that great physician Diocles of Carystus, who lived probably at Athens, but which found its development in Alexandria; schools of which Celsus is our eminent exponent. The third tributary was the Hellenistic medicine of which Asclepiades was in Rome virtually the first, as Galen was the chief example.

In an inchoate society, founded as was Rome, in the year 759 B.C., on some federative basis, the faculties of religion, law, custom, medicine, agriculture, could not be fully differentiated: we shall see how long a time it took to release medicine from other functions, especially from religion and custom; and even then how vehement were the later conflicts and reactions between clinical and scientific medicine, priestcraft, and folk-lore. Magic, medicine, religion; Dr. Rivers, in his *FitzPatrick Lectures for* 1916, showed how implicated, or rather integrated, were these three in early civilisation; in Osler's phrase "they arose out of the same protoplasm": so connate were they that they are not altogether disentangled yet, though Medicine be now almost independent and self-defined. If among ourselves the contrast between natural and supernatural may not yet be always distinct, it cannot even find a place in the minds of primitive peoples. Medicine in early times had of course a much larger scope and meaning than mere doctoring. As a magic it gave access to the sources of good fortune, and the priest held a stronger spell than lay people, herbalists, or moralists. Yet it is true that most ancient Roman physicians seem to have been lay—not sacerdotal ; "*medicus*" is said to be an old Roman (Oscan ?) word.[1] Payne divided Roman medicine into three sources : (1) Sacred rites to gods of healing ; (2) deprecatory rites to malignant gods who caused particular diseases ; (3) empirical popular medicine ; divisions which are clearly home divisions. Cicero, by the way, had come to see the impropriety of paying religious rites to the malevolent deities ; as to Febris, Mephitis, Tempestates, Mala Fortuna, etc.

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[1] Rome extended her sway over Magna Graecia after the Second Punic War, and so involved herself in Greek culture.

Whatsoever elements of a spiritual religion the Romans of the earliest time may have inherited, such early records are very scanty, it soon hardened into "dry, formal, and contractual" observances (Fowler). Sin, or error, or ineffectual prayer, lay for the suppliant in some omission or default in the accomplishment of his rubric. His attitude was one of "timorousness" towards plaguy, short-tempered, freakish, and exacting goblins or powers of the air. Some of the nearer godlings, it is true, were gradually propitiated and tamed, as Lares and Penates ; but even these haunted the recesses of the house, and never became quite genial and homely. When the matrons flocked to different temples for prayers against Caesar's advance, as Lucan says, "*divisere deos*"—they parted the gods among them. Salus, Mars, wardens of health, and Lucina and Carmenta of childbirth, Febris, Mephitis, were primitive Italian deities. The

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[1] The word *ἰατρός*, otherwise *ἰητρός* (in the Ionic fashion of Athens), *ἰητήρ*, *ἰατήρ* (Cyprus) *εἰατήρ* (Sicily), *εἰητήρ*, *ἰητώρ* (Trikka), *ἰατρός*, *εἰητρός*, *εἰατρος* (Syria), is derived not from *ἰάομαι* which, with its kindred words, is from *ἰός*, but from *ἰαίνω* (P. Giles, Postgate). The word *ἀκέομαι*, I heal, may come from *ἄκος* root *ακ'*—a prick or thorn. Among certain tribes a long thorn is run through the edges of a wound and a thread wound round to keep all together (Giles). In Boeotia (Thebes) and in Seleucia we find the name *σάκτας* for a physician ; this reminds us too nearly of *σάκτωρ* (Aesch. *Pers.* 924) one who fills up (Hades); *i.e.* a destroyer of men. In commenting upon a fourth-century inscription in Cappadocia Professor W. M. Ramsay on the word *ἰητρός* says : "Perhaps the Ionic form is due to ancient medical influence from the great schools of medicine on the West Coast" (*Class. Rev.* 1919). We know that in later times to write in Ionic became a medical affectation (p. 277).

Romans then were a superstitious but not a religious people; to this day the Italian people trust more to ritual than to the movements of the spirit. As in modern Germany, Rome starved individual religion by identifying it with the State, and by using it as a buttress to the imperial power. In this aridity of old Rome we cannot wonder at the thirst for the more spiritual and personal religions of Greece and the East—for the influences, Orphic, Pythagorean, Oriental, which came in by Cumae, Magna Graecia, and even by Etruria.

Folk-medicine, whether independent or still engaged with religion and custom,[1] belongs to all peoples and to all times, including our own; it is not the appanage of any nation; it is rooted in man, in his needs, and in his primeval observation, instinct, reason, and temperament. Still it is largely modified by the kind of man; for instance in the Greek, folk-medicine was soon separated from theurgic medicine, and even from mysticism; so that a natural and scientific medicine was more quickly conceived and built up. The necessarily sceptical attitude of professional medicine, engendered by the infinite complexity of function and the baffling conditions of observation, an attitude which even commended it to the subtle, inquisitive, and irresponsible apprehension of the Greek, was for the ceremonious, slow-witted, and dogmatic Roman even more intolerable than it is for our own fellow-countrymen to-day. To folk-medicine doubt is unknown; it brings the peace of security. If infallibility failed! why, then, the game was not played exactly. From Cicero we learn, as in modern Rome, the potencies of an inflexible ritual exactness; for until every potentially hostile earth spirit were placated, a long and tedious process, mere human means were ineffectual. First of all, the right deity for the job had to be discovered; let us say, for fortune Mercury, Neptune for a voyage, Robigus against the mildew, and so on.[2] Then he tells us how there was one priest for ceremony, another for formula. If a word was altered, if a flute player rested, if an actor stopped short, the rite was broken; all must be recommenced. Prayer and personal observance had to be no less pharisaic.[1] So in medicine; first, the proper god or godling had to be ascertained; then the proper formula of magic utterance to accompany the drug or operation, which, as we read in Cato and elsewhere, was to be recited with rigid precision. As Dr. Rivers showed in his *FitzPatrick Lectures* (1915) specialisation is carried to extremes in rudimentary societies, but this particularism is to be distinguished from the narrow paths which in our times lead by postern gates into the citadel of truth. However this specialising habit was almost as extreme in Rome as in Egypt; as there were gods, so also doctors for fistula, hernia, and other small or partial ailments, or kinds of remedies—as for eyes and ears, gynaecology, etc., for training exercises, baths, and so on.

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[1] Mr. Warde Fowler points out that the rites of Rome, whether Etruscan or Old Italian, are to be regarded separately from the religion, much of which came from other sources.

[2] These troops of specialising gods held their sway long before Rome. In the Hippocratic treatise on the *Sacred Disease* a vigorous attack is made upon the notion of a godling for every symptom.

Of supernatural or magical observances, "binding and loosing," the virtue of laying-on of hands, the discovery of names, lustrations, holy wells, dreams and their interpretation, temple incubation, and the fantastic notions of signatures and sympathy I shall speak presently.

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[1] I read this year (1910) in a certain church, and over the signature of an eminent archbishop, that forty days of Indulgence would be obtained by saluting a particular crucifix and reciting one pater and one ave. But for one unable to go to this image twenty paters and aves would be required; one for each of the fourteen stations of the Cross, five for the five wounds, and one "à l'intention du saint Père." Thus tenacious is ritual tradition. In the recent controversies around the death-bed and burial of the late Mr. Tyrrell much curious matter of this kind was notable.

CHAPTER II

PRIMITIVE ROMAN MEDICINE—*continued*

PRAYER for the old Roman arose in no sense of sin; as Cicero frankly says, it was not to make him good, but for material benefits, for a bargain with the proper deity—"si deus, si dea . . . ," as Cato would commence not only medical operations but even the felling of a tree—for help, health, or wealth. In the hard business of Roman religious contracts the mystical elements of Greek and Hellenistic religion had not then any acceptance. Fortune, says Mr. Warde Fowler, was the favourite goddess of old Rome, and he aptly shows that *sacrum* with the Roman meant no matter of feeling but of law and rite; the gods were placated and so gradually taken into the community as a kind of citizens.[1]

Furthermore, to comprehend this matter, we must appreciate the unit on which, during its integrity, the Roman State, honour, prowess, and fortitude were built up; this unit was the household, a body animated and governed by husband and wife, who in early times were married sacramentally and indissolubly by *confarreatio*, or wedding cake eaten with the Deus Domus. This custom was a public rite as well as an initiation into the *sacra domus*. Herein the Etruscan and the northern traditions were similar.[2] Although for various reasons, good and bad, *confarreatio* became less frequent and divorce more frequent; and, as with the women in all wealthy societies, extravagance in dress, luxury, and morals increased, yet even in these days women ranked much higher in Rome than ever in Greece. A striking warrant of this status of woman lay in the idea that there should be one law of sexual honour for man and woman alike. This law was as old as Plautus (*Mercator* iv. 6), and was approved by so shrewd a man of the world as Montaigne.[1] But, though the wife within her sphere was held in honour, the authority of the paterfamilias was supreme, originally even to life and death.[2] The Roman children, somewhat after the manner of the English, received little intellectual but a good moral education—namely, to be manly, silent, modest, obedient, sober, and devoted to the State and the gods, ideals which were indeed almost identical. As with our own youngsters however, the pampering effects of wealth, luxury, and idleness gradually undermined this discipline.

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[1] For much concerning Roman manners I have, of course, to acknowledge our common debt to Marquardt.

[2] This honourable place of woman in a people of oriental stem is very remarkable. In the British Museum the passer-by may see at a glance the Etruscan wife, sitting at a table with her lord, equal in sepulchral honours, etc. As I have said, it was a tradition in the Julian House that the wife should stand by her husband in great affairs; as did Cornelia by Caesar.

Now, among his other functions, the paterfamilias was medical officer of health and physician to his household, which included his slaves and his cattle. Veterinary medicine, as we gather from Cato to Columella, and onwards to Vindicianus the friend of Augustine, had a considerable part in Roman economy; and I regret that my present limits forbid me to make use of its interesting lights upon our subject. Again, as medical officer of health the paterfamilias had to fence out, not only his adversaries, or chance marauders, but also those hostile spirits whose arrows were sickness and pestilence. Upon him, under the auspices of Mars the god of boundaries, lay the responsibility for the precise formulas by which they were to be repelled, and the safety of family, cattle and crops within his consecrated precincts secured. We read that Cato sought to ward off a certain calamity by a processional sacrifice. And if, after all, disease appeared, or in any case if his wife lay with child, or a slave broke his leg, this practical man expected his deities and his traditions together to provide him with the right weapons to fight the disease, the pain, or the injury. These means, though in part magical, yet included the aid of simple operations, and of certain drugs, mostly herbal. Up to the time of Cato the folk method was theurgy *plus* the drug; then the drugs, escaping gradually from the theurgy, ultimately attained the marvellous compound virtues of the galenicals and mithridatics which, at a later date, seemed scarcely less supernatural.

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[1] See however p. 14 note [1]. Professor Buckland's correction.

[2] This dominion of the household has persisted among the Latin peoples to this day; it is said that at one moment the old Marquis Mirabeau had every member of his family under lock and key. Another side of the matter is that the love of home has never, it is said, been more intimately expressed, even by English poets, than in poetry or prose by Romans—as, for instance, in the *Eclogues*; one may note especially the charm of the old country family on the Mincio, a comparison, however, which may need some qualification.

Of natural products those that were far-fetched, or notable for oddity of source or feature, or for peculiarity of taste or odour, readily found their way into the pouches of the healers; and as, in the earlier days we are contemplating, there were not yet in Rome pharmacists, perhaps not even professed cullers of simples, these specific products were gathered, or procured from the merchants, by the paterfamilias, and placed in the store closet or Penates, which holy shrine held the guarantees of the well-being of the family and estate. The Penates then were in part the material of folk-medicine in every household, and paterfamilias was the high priest.

However, we need not suppose the materia medica to have been a very meagre collection. Self-contained, austere, and rustic as was the older Roman, it has always appeared to me that Marquardt and other civil historians have laid too little stress on his trading capacity. Much of the vast wealth of the empire was no doubt acquired as spoils; and Ostia, like Marseilles, lay out of the line of tolls which enriched Sheba, Jerusalem, Tyre, Mycenae, Corinth, Venice, and other keepers of the gates of traffic; yet even before the Punic wars, and long before the possession of Alexandria, Rome was the centre of no inconsiderable commerce. The site of Rome, like that of Athens, combined the advantages of inland security with those of a seaport not too far away. Moreover the recent excavations on the lower Tiber have discovered two ports; the newer port of Ostia built, in the security of a command of the sea, farther from the guardian city, was a splendid mercantile town of stately warehouses and tabernae, and of rich dwellings containing precious works of Hellenic art. This Ostia, when the old harbour had silted up, was constructed under Claudius lower down the river. But the nearer Ostia, said to have been founded by Ancus Martius before Rome had command of the sea, was the ancient and by no means inconsiderable emporium of Republican Rome, and of its turnover the spice and drug traffic was no insignificant part (see p. 25; and herbals, iology, Chap. XVII.). The greater the perils and the hardships of transit the more portable the articles of merchandise; and in early Rome, before the destruction of Carthage and the suppression of piracy by land and water, a large part of the trade would consist of the spices, incense, and those rare unguents, such as styrax, myrrh, spikenard, or opobalsamum, in precious boxes under seal and signature (epangelia), which in early and medieval times were so universally in demand as, with gold, gems, ivory, silks, etc., to kindle the adventure and paint the romance of the merchants of olden days.[1] In great houses, in guilds, in monasteries, these medicinal Penates were handed down to later times; and for domestic and charitable uses interpreted by such books as *Le Manuel des Dames, formules de médicaments . . . remèdes aux pauvres*, etc.; Bonham's *The Chyrurgion's Closet et Antidotaire*, and the like. In the old Yorkshire homes of my childhood there lingered still the locked cupboards containing the quaint jars and hieroglyphic coffers, aromatic of pepper, allspice, cinnamon, conserves, and strong waters; and charged also with the less attractive redolences of only too familiar drugs and draughts. Our grandmothers and aunts, who, like Diana of Poitiers, were well versed in domestic medicine, made and administered our potions and powders, and those of the more grateful poor. We children liked better to search their pockets for the pretty silver grater with the rattling nutmeg hidden in the head of it, for the arabesque and antiseptic vinaigrette, and, in the depths, for a few corns of cloves so warm to our teeth. Pardon my garrulity—of memories running back upon these Penates, and far beyond these, to the marvellous legends of the spices guarded by winged serpents, and by ants in size somewhat less than dogs, but rather bigger than foxes, which had been gathered for our child's story-books with their queer woodcuts, from the innocent pages of the Father of History. Of these exotic trucks, pepper especially counted for much in Roman as it did in medieval trade. I had been wont to suppose that the pepper was only to preserve and give sapidity to the staling meats of winter; but Mr. W. H. S. Jones has pointed out that no doubt it was also used extensively as an antidote to the malaria. On the importation of the malaria then—whensoever after the early bloom of the rich cities of Magna Graecia this may have been—that of pepper must have increased in some correspondingly enormous proportions.

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[1] The μυροπῶλαι probably dealt in the drugs and essences severally—the "simples" (τὰ ἁπλᾶ); their combinations in mixtures came later, and may have been dispensed by the φαρμακοπῶλαι.

But I repeat old Roman folk-medicine did not consist by any means in simples and in spices only; it consisted no less in customs, rites, and magic; some engendered of the natural brood of mankind, such perhaps as the primeval creed of the great Earth Mother, or the custom in folk-medicine of laying out the sick in the highways for the aid of some passing traveller; some imported from the East, as by the Etruscans, by the opening out of the East in the Persian wars,[1] by the campaigns of Alexander, who carried a magician with him as well as the *Iliad*, and by the avenues of commerce. From the Oxus, from Mesopotamia, from India and Sheba and the Persian Gulf, possibly even from the tin islands of the Far East, by the Caspian and Black Sea to Sinope and the Balkans, or by the old caravan track still extant from Byzantium to Ragusa; or by the Royal Road through the Cilician Gates and Pteria to Ephesus; or, again, through the lesser desert to Hebron, Jerusalem, Tyre, Nauplia, Mycenae, and Corinth, there had been for centuries untold perennial streams of merchandise as well as of ideas. The wide and various wanderings of the old Greek philosophers and historians, and their harvests of learning and experience, were not likely to be forgotten; for, in days when manuscript was rare and meagre, memory was retentive. Of Minoan medical tradition we know little; we do not know whether it blended gradually into the Hellenic, or the continuity was broken; how far or whence it was oriental; how far its ideas, as indicated by the palmette, lotus, griffins, lions, etc., came in from Egypt, Assyria, and even from the Hittites. Phoenician influence seems to have been derivative and secondary; indeed the many resemblances between Mycenaean and archaic Greek relics may be merely the common elements of all primitive arts.[2] Yet not in Hippocrates only, but even in Homer we find medicine freed from magic and superstition; the contrast in this respect between Ionia and Thessaly the home of myth, magic, and legend being very remarkable. In the Middle East we are finding heaps of clay tablets in Assyrian script recording traditions of magic, astrology, and demonology, probably even of Sumerio-Accadian origin. In the light of our modern knowledge of the wide and frequent diplomatic intercourse brought to light in the records of ancient Egypt, it is not to be supposed that their hoary ideas did not reach and widely affect the Western peoples, in degrees of more or less, as their respective avidities might be. The conflict and dispersion of ideas in the East was perennial and incessant. On the other hand however I think that recent discoveries in Egypt, in India, and even in China,[1] may tempt us to attribute too much of Western culture to Oriental origins and ideals. The general truth seems to be that, Christianity apart, Oriental thought has been sterile and, for us, vain. It has often coloured but never has it formed Western thought; scarcely even in Venice or Naples. The Moslems of Spain, brilliant ambassadors of culture as they were, made little positive contribution to the sum of knowledge, unless it were in some chemistry and mathematics.

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[1] Pliny's story is that Xerxes brought with him a magus called Sothanes, whose influence penetrated widely in Southern Europe; "qui velut semina artis portentosae insparsit."

[2] See many papers by Evans, Hogarth, Poulson, S. Gardner, and others.

One of the most pregnant conditions of the diffusion of culture was by the immemorial consecration, for security of market and travel, of certain central marts and places of congregation; such as Dodona, Delphi, Delos, Ammon, Mecca (long before Islam), and, in less awful sanctity, Hebron, Zion, Tadmor; international refuges, each under the ward of a great god, or of an ancient and wise king, such as Melchizedek or Solomon, and often, as at Dodona or Delphi, the seat of an articulate organ of divine messages to mankind. When, after Chaeronia Delos was restored as a free port (166 B.C.), and became the commercial centre of the Aegean, it was no less a mart of creeds—as of Isis, Cybele, Hadad, or Atargatis, "against which the Italian gods were of little account." Because, as I have said, these were gods of baseness, not of holiness. Homely as the primeval Romans were, we may be sure then that the voices of the oriental merchants, sages, and soothsayers penetrated even to that secluded nest of its mighty brood, already nursed in the augury and haruspicy of the Etruscans; a divination which however in nature and character may appear rather as a kind of natural research than as witchcraft.

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[1] In the reign of Trajan a Chinese general reached the Caspian and tried to open up some intercourse with the Romans. Professor Giles detects Greek loan-words in the Chinese language, and relics of Greek origin can be traced thus far, the borrowing being, however, not westward but eastward. Pliny the Elder recognised (*N.H.* xii. 19) the unction of trade in the diffusion of ideas.

That in his early ages man should be attracted more by rare incidents than by common sequences is not surprising. A chicken born with three legs was a sign from the hidden powers of Nature; the Roman Senate was summoned for its interpretation, as the Royal Society congregates to muse upon radium. The augurs were a college of scientific experts; and deflections in the flight of birds, or in the currents of occult life in the entrails, were phenomena significant of the working of larger causes in which man was deeply concerned. The people who best could read these signs should therefore prevail. Unfortunately the Roman, like other augurs, learned to love authority more than prophecy; and Ménière surmises that these priests were adepts in anatomical tricks, such as bleeding from carotid or jugular vessel as they saw fit.

> Nec cruor emicuit solitus, sed vulnere largo
> Diffusum rutilo nigrum pro sanguine virus.
> LUCAN, *Pharsalia*, i. 614-15.

We perceive then that the study of religion and superstition, which coloured all Roman life, is far too vast for this occasion, albeit its influence upon folk-medicine was too considerable to be dismissed without a word. In the infancy of human societies theurgic and Priest-King methods can hardly be called superstitions; they belong to that provisional framework of custom by which early societies are integrated and bonded together; and, if in Rome theurgic and other rituals have had a longer reign, we must remember that the mission of Rome has been one of integration, subordination, and rigid consolidation; not of revelation. In its classical place in Livy, who is full of prodigies, we read (vii. 2-3) of a great holy feast to gods during a severe pestilence in the sixth century—eight days of it, to Apollo, Latona, Diana, Hercules, Mercury, Neptune, with religious drama and dances. When this failed, the curious, apparently Etruscan rite[1] of driving a nail into the temple of Jupiter would be performed. Not only perpetual wars, but also the greater curse of Rome, the malignant pestilences, often no doubt the plague itself imported by traders, or perhaps the first invasions of malarious disease upon a people not yet even partially immunised, or again the commoner infections envenomed by foul conditions of life (though in the reign of the early kings the conditions of a scanty, hardy, outdoor population cannot have been very foul), blow upon blow, and time after time, smote and devastated Rome; sometimes "killing without illness," many times destroying both men and cattle, blighting even trees and crops also, they drove the people into gloomy terrors during which these public rites, horrible as some of them were—such as the well-known immolation of 120 women against the plague—at any rate saved the nation from despair.

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[1] This observance (primarily an almanac (?) but the links are obscure) is traced up to the Volsinians, and to the Etruscan goddess Nortia (vide *Mitth. Gesch. Med.*, 1904, p. 200), and down again to the Hindenburg statue. I think the alleged secondary link with the virtues of the nails of the Cross has not been verified.

Down to the time of Cato, the application of natural, and the invocation of supernatural means lent, each to the other, supplementary and material aid. In the gathering of simples some peculiarity of form, colour, odour, or other strangeness of feature or outlandishness of habitat gave it, as I shall note presently under signatures, a hold on the attention; yet in the culling of the herb, or the brewing of the potions, were to be regarded the mystic influences of the seasons of the year, and of saints' days, such as the Eve of St. John; of the new birth of spring or the decay of autumn; of the influences of the hours of the sun, of the phases of the moon and of other heavenly bodies and constellations; of heat and cold, dryness and moisture; of the congruities of numbers, of precatory patter, and so forth.[1]

Of supernatural or magical observances the more specific were incantations; "binding and loosing"; the virtue of laying on of hands; the potency of names, lustrations, unguents, holy wells, dreams and their interpretation; temple incubation with its corresponding donaria; the fantastic notions of signatures and symbolisms, of sympathy and analogy, of talismans: all these observances entered deeply into early Roman as into other folk-medicine of those and of later times.[2] Remnants of them survive amongst ourselves, especially in the conservative functions of our churches, and beside the sick-bed of helpless men, where the grosser kinds of mysticism still endure, and even flourish. No wonder then that magical and occult ideas and practices entered into the very framework of Latin medicine, not in the cruder times of the Republic only, but, in rising and falling tide, in the earlier Empire, the later Empire, and during the ages called "dark." The demonology of Roman folk-medicine carried its pedigree back far beyond Endor, propagated its kind through the Middle Ages, and has still in the "morbid entities" of our own nosologists a pale survival.

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[1] That to the selection of the more effectual herbs early man was guided, as Haeser suggests, by some instinct seems improbable; he was no doubt guided by some rough empiricism.

[2] Here I may lament the early death of Hugo Magnus, whom we may regard as almost the first historian of folk-medicine, and of its relations to religion and philosophy. See *Abhandlgn. d. Gesch. d. Med.* xv. 112, etc.

Amid these oracular, ceremonial, mystical, exorcistic, and occult agencies of magic and practice the priest, as the necessary mediator and interpreter, had a chief place; his function was a far stronger motive with the Roman than with the Greek people, and is scarcely less potent in Rome to-day. From such writings as the Coan and Cnidian Sentences we learn how early in Greece were the indications of the detachment of professional from folk and theurgic medicine; and, negatively, that in all the various books of the Hippocratic Canon Temple medicine has barely an allusion. To this independence I shall refer again presently. In Greece the theurgic invocations of Apollo Paeon, of Chiron, of Aesculapius, seem soon to have become, as in the Oath, rather of the drapery than of the body of medicine. "Church was one thing, common sense was another, and he wanted nobody to tell him what common sense was"; is there not a flickering light of rational kinship between Hippocrates and Mr. Tulliver? Even in Celsus the shapely adolescent form of scientific Medicine, if then becoming more acceptable to the newer and cultivated Roman, was, notwithstanding, in content and temper wholly Greek; to the Latins it owed nothing. But in Rome, and not during the Republic only, theurgic, or hierurgic, or magical craft "and those who used curious arts"[1] were of the body of it (Chap. II.); drugs and operations were but auxiliaries.

To understand Roman medicine aright therefore I must touch, however briefly, on some of the chief of the miraculous observances to which I have referred.[2]

Incantation is too well known to delay us long. On the jargon of Cato's time I have touched already. Indeed we may congratulate those treated by incantations, which were far more agreeable and more efficacious in suggestion than such disgusting remedies as composts of fowls' dung, asses' hoofs, pigs' eyes, or the gall of the hyena. It is remarkable how little trace of magic there is even in the *Iliad*, medicinally speaking; there we find good wound-surgery, with styptic and anodyne remedies. Apollo's arrows and the expiation are another matter; this process had in it indeed a strong element of human justice. But in the *Odyssey* (xix. 457) the haemorrhage of the wounded Odysseus is stayed by "ἐπαοιδή."

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[1] Acts xix. 19, They burned their books and counting the price of them found it 50,000 pieces of silver.

[2] In these paragraphs I am indebted in part to the various essays of the late Hugo Magnus, especially those which appeared in the *Abhandlungen z. Gesch. d. Medizin*; also to the treatises of Deubner and Weinreich.

Binding and loosing, a kind of magical enthralment, or a throwing of function in and out of gear, had obviously its direct medical application to childbed; and also to maladies of the kinds of hypnotism and hysteria. The very ancient goddess Carna was primarily the warden of lock and key, and thus became the goddess of the lying-in chamber; then of the strength of the stomach, and so on. As the method, from early ages, as recorded in cuneiform script,[1] down to its attenuated survival in modern rituals, was intimately connected with the laying on of hands, or the sign of the hand, it is difficult to consider the two methods separately. For instance, in childbed loosing was often done, or signified, by a laying on of the hands of the healer, or by a gesture of the hand, so that often in greek χείρ and δύναμις became equivalent; furthermore, in many legends, as in modern hypnotism, it is not easy to perceive whether the manual act were one of a stream of virtue from the healer to the patient, a manumission, a protective gesture, or indeed, as in not a few cases, medically operative. For example, in childbirth the hand of a god may be laid upon the abdomen, so that from it the solvent virtue may flow into the womb; or the act may be only symbolic, as in the idol of a goddess of fecundity found at Cnossus—I take this instance as carrying us back to the Pelasgian people—in which the elevated right hand is widely opened; the left, for the left hand had even then its sinister potency, being closed. The Eileithyiae are often represented, upon the so-called Etruscan vases, with the right hand thus raised and opened. To close the fingers would arrest the birth. These daughters of Juno or Hera were however always beneficent goddesses, both for marriage (Hera Eileithyia or Ὑπερχειρία) and childbirth. But they are often shown as more than guardians; not only blessing by symbolic gesture but also laying the potent hand upon the body, or even performing some efficient act. They appear thus on some Etruscan mirrors; and in later times we read in Ovid of Leto's childbed (*Met.* x. 510).

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[1] *Vide* Oefele in Puschmann's *Handbook*.

> Constitit ad ramos mitis Lucina dolentes
> Admovitque manus et *verba puerpera* dixit.

> Lucina to this wofull tree came gently downe and layd
> Her hand theron, and speaking words of ease the midwife playd.
> (ARTHUR GOLDING).

Now Soranus observed that the pangs of childbirth are mitigated by the laying on of a warm hand; but this very ancient hand magic was by no means confined to midwifery. Chiron, Hygeia, and Apollo had the attribute of ἠπιόχειρος (the soothing hand), which passed on in later tradition to the hand of the Mother of God—χεὶρ τῆς παναγίας. For instance, the Dioscuri, Asclepius, Serapis, Cosmas and Damian, thus saved from sickness, as also from storm at sea;[1] and to-day the modern Italian mother takes her sick child to the little circular church of "San Toto," at the foot of the Palatine, where, perhaps at this very temple, the old Roman mother used to invoke the Great Twin Brethren.

Such gestures were used also for maleficent purposes (*mala manus*), especially, as I have said, if made with the left hand; of this side of belief we find abundant evidence in sources so different as Petronius and the *Acta Sanctorum.* Asclepius would thus use his magical powers, generally during incubation. In an Epidauric inscription so late as the fourth century A.D. he is said to have laid his hand upon the body of a sterile suppliant, who gave thanks for the son she came thereby to bear. By raising the eyelids with his fingers he restored a blind man to sight; in another patient by stroking the hand he dissolved (a Dupuytren's contraction?). And, as I have said, by means more specific than gesture, this god of Medicine often showed his good-will: to one he holds out a potion, another he anoints with a salve; or he performs an ablution, even with a sponge ("nescio a quo deorum spongea corpora sua pertergeri," Val.

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[1] *Vide* Deubner, *Kosmas u. Damian,* Leipzig, 1907.

Max. ii. 4. 5); or with his miraculous hand he does swiftly an operation which the mortal physician achieves far more laboriously (Weinreich). St. Eligius, patron of a street near my own house in Cambridge, cured a dumb woman by snipping the bridles of her tongue "cultellum etiam vel forcipem in specie medici manu gestans" (see *Vita Sancti Eligii* in Migne). Similar manipulations were still related of the medieval Saints, as by Gregory of Tours, Cosmas and Damian, Cyrus and John, and others. In the Lake Harris community persons "infested" by "infernals" were watched until suddenly the cry would arise of "Bind him, Lord." Apparently concerning malaria, in an inscription[1] of the earliest years of the Empire found in the Asclepieion of the island of the Tiber, the donor sets up his εὐχαριστήριον [’Α]σκληπιῷ θε[ῷ] μεγίστῳ [σ]ώτη[ρι] εὐ[ε]ργέτῃ ὄκνο[ν] σπληνὸς σωθεὶς ἀπὸ σῶν χιρῶν. ("To Asclepius,[2] supreme God, Saviour, and Benefactor, who by his hand saved me from torpor of the spleen[3]). How by these epiphanies and miracles Julian, and many of the neoplatonists, endeavoured to identify or to connect Asclepius—known from ancient times as mild (ἤπιος = *mitis*)—with Our Lord is well known.[4] Proclus, in his *Hymn to Athena*, sings:

> ναὶ λίτομαι, βασιλεία, καὶ ἀμβροσίῃ σέο χειρὶ
> παῦσον ὅλην κακότητα μελαινάων ὀδυνάων.

Verily, O Queen, I pray, even with thine ambrosial hand spare me all this evil of black pains.

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[1] Besnier, *L'Île tibérine dans l'antiquité*, Paris, 1902.

[2] On Asclepius and ex-votos cf. Roscher's *Lex. s.v.* "Asklepios" i. 627a; Frazer's *Pausanias* iii. 248 ff.; Daremberg and Saglio i. 471; and S. Reinach, *Épig. grecque*, p. 82.

[3] Mr. A. B. Cook writes: "I agree that ὄκνο[ν] σπληνός would have to mean 'torpor of the spleen,' though ὄκνο[ν] does not strike me as a very natural word to use of such an ailment. But in M. Besnier *L'Île tibérine*, Paris, 1902, p. 213, the text of the inscription is printed thus:

ὄνκο[ν] | σπληνὸς

and that can only be for ὄγκον σπληνός, 'enlargement (? tumour) of the spleen.' I should not venture to emend ὄνκο[ν] into ὄκνο[ν]. If the allusion is to Asklepios curing the malady by laying on of hands, I should compare Herondas iv. 16 ff.—

> ἴητρα
> νούσων ἐποιεύμεσθα, τὰς ἀπέψησας
> ἐπ' ἠπίας σὺ χεῖρας, ὦ ἄναξ, τείνας.

Besnier's rendering: 'sauvé par tes mains d'une tumeur de la rate' seems to me right. H. van Herwerden, *Lexicon Graecum suppletorium*, ii. 1592, quotes several examples of 'χεῖρες, artificis opus.' In any case χιρῶν is mere itacism: *id. ib.* ii. 1591 cites from a papyrus of the age of Claudius or later ἐξεδόμην σοι τὴν χῖρα μου ταυτην πρὸς ἀσφάλειαν. Also cp. old Latin *hir* = χείρ."

[4] *Vide* Mau, *Die Religionsphilosophie Kaiser Julians*, Leipzig, 1908; quoted Weinreich.

Cf. the prayer for the like effect of drugs:

> φάρμακ' ἀκέσματ' ἔπασσε μελαινάων ὀδυνάων,
> *Iliad* xv. 394.

And, thus figuratively, potent medicines received the name of the "hands of the gods"; as in Pindar of Asclepius (*N.* iii. 53) "τὸν φαρμάκων δίδαξε μαλακόχειρα νομόν." And so again in Plutarch we read "Τὰς βασιλικάς, καὶ ἀλεξιφαρμάκας ἐκείνας δυνάμεις, ἃς θεῶν χεῖρας ὠνόμαζεν Ἐρασίστρατος." ("Those sovran remedial agents which E. has called the hands of the Gods"). As J. F. Payne said of the Anglo-Saxon leech, "his more pedestrian medicine and surgery would hardly keep pace with the brilliant thaumaturgy of the ecclesiastics." Scribonius Largus, and Celsus likewise in his Preface, say of Herophilus, "fertur dixisse medicamenta divinas manus esse"—"οἷόνπερ θεῶν χεῖρας"—etc. Alexander of Tralles gives the same title to an infallible remedy against stone of the kidney (A. v. T. ed. Puschmann ii. 466); and Weinreich states that in the current *Pharmacopoeia Danica* is a "Guds Haands Plaster." I am told of the West of Ireland that in doctor and nurse a "lucky hand" is preferred to any academical qualifications. How by the touch blindness may be cured, or inflicted we know, not only from such familiar stories as of Teiresias and Elymas—sometimes with the aid of ashes or water from the altar, or of spittle,[1] or of holy relics, or of clay; we find the same procedures also in inscriptions of Epidaurus, of the Asclepieion of the Tiber, and of the Asclepian temple attached to the baths of

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[1] How ancient are the virtues of spittle, especially of fasting (*i.e.* uncontaminated) spittle, from epilepsy to warts, I need not stay to illustrate—for example:

> "Foot, foot, foot, is fast asleep,
> Thumb, thumb, thumb, in spittle we steep," etc.

And in Tacitus (*Hist.* iv. 81) "Precabaturque principem ut genas et oculorum orbes dignaretur respergere oris excremento."

The saliva was supposed to contain a concentration of the vigour of the individual; if he went mad his saliva became poisonous. This we find from Pliny (xxviii. 7 and 22) and Aetius and Paul (see Adams' ed.) downwards in time to Barthol. Angl. etc., and it appeared still in the pharmacopoeias of the eighteenth century. Salt, as actually, and so symbolically, a preservative, was often mixed with saliva for use against the evil eye. (See Council of Trent Catechism.) Thus it was that the mixture became a part of baptism—signifying freedom from the corruption of sin, and the savour of good works. I remember reading, in an interesting article in an archaeological journal, that on a panel of a font in S. Margaret's Church in Ipswich is inscribed *Sal et Saliva*. Marcus Empiricus gives a formula for removing a foreign body from the eye: open it with three fingers of left hand, spit thrice on the ground, recite certain words (gibberish) and the foreign body will promptly drop out.

Diocletian. In the *Vita Hadriani* (quoted Weinreich) we read "Venit de Pannonia quidam vetus caecus ad febrientem Hadrianum, eumque contingit. Quo facto et ipse oculos recepit, et Hadrianum febris reliquit." In the Serapis temple at Memphis similar miracles are recorded of Vespasian, who may have believed as much or as little in his royal touch as Queen Anne did.[1] I may add however the story from Pliny (*Hist. Nat.* vii. 20), how Pyrrhus, by the touch of his great toe "(cuius tactu) *lienosis*[2] medebatur." Pliny (*ib.* xxviii. 43) speaks of the cure of epilepsy, "Si virgo dextro pollice attigat" ("Let a virgin touch him with her right thumb"); and Alexander of Tralles of the ἰατρικὸς δάκτυλος (ii. 199, ed. Puschmann). Thus the virtue of the hand might emanate from any limb, or from the garment, or a relic; but the magical virtue of the thumb or the great toe was more than this. These parts, by the analogy of form so catching in early times, acquired also a phallic significance. In the nearer East, especially in Italy on the feast days of SS. Cosmas and Damian, under the name of thumbs, of this saint or that, the emblem, in wax, is to this day commonly sold to sterile women; or as a votive offering. Sir William Hamilton at Isernia noted this practice also, on St. Januarius's Day. St. Thomas Aquinas cured a blind man by the simple device of allowing the patient to kiss his foot, a prerogative shared with Popes and Emperors.[3] It was by this pedigree that the royal touch came to us in England; and it is farther illustrated by certain ancient Gaulish and Spanish practices of royal touching for jaundice, plague, or insanity.

To the evil of the sinister hand I have referred; but I may remind you also of the perilous stroke of the god, or ghost, of which, among many instances, that on the hollow of Jacob's thigh is the best known. To such a blow the Arabs attributed the "divine disease"—epilepsy; and the legend of the Incubus belongs to the same line. On the well-known enthralments of magic circles, pentagons, garlands, belts, and rings I need not tarry. Magic rings were a symbol of Binding; but pierced stones of "Entrances," or "new starts." The patient was passed through, if the hole was large enough; if too small he was passed through symbolically.[1] The Premonstratensians of Coverham possessed the iron girdle of Mary of Middleham, which they lent to women in childbed.

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[1] It was, I think, in the time of the Georges that advertisements appeared postponing dates for the suppliants, as "the king wanted a holiday from healing."

[2] Italics mine, to indicate the malarious connotation.

[3] Troels-Lund (*loc. cit.*) says the fingers of dead thieves stolen from the gallows were preserved in brandy for their healing virtues.

On the magic of *Names*—that to discover the name of a person is to obtain some power over him, or some intimate access to him, is an ancient notion scarcely yet extinct. Herodotus says in awe (ii. 123) "*Τῶν ἐγὼ εἰδὼς τὰ οὐνόματα οὐ γράφω*" ("Their names I know, but will not write"). Patients, by no means all of the ranks of the hospital classes, feel that if they can get hold of the name of a disease they thus penetrate nearer to its essence, and obtain some greater measure of control over it. In Jacob's conflict it will be remembered that his supreme effort was to learn the name of his mysterious antagonist. This power of the name, too general a belief to need farther allusion in this place, was in full force in ancient Rome. Naming and Binding were often associated; even down to the later Middle Ages impotence and sterility were to be inflicted by tying a knot in a cord with incantations and naming the person.

The magical virtues of *numbers* are too well known to require any long description in this place. In early stages of thinking numbers, as entities, were confused with ideas, and with causation; they gave to phenomena and to causation a sense of order and progression. Moreover they were verifiable, so that by them all things might surely be measured; and between measure and law the distinction was misty (p. 95). Certainly in music and in astronomy numbers were of striking validity; and, if so, why not in the bodily courses, in physiology and disease. Whether magical or critical, numbers entered deeply into medical system and prognosis, very deeply even into Hippocratic medicine; but not in Greece and Rome only: we find the same or similar beliefs among the Chaldeans, the Jews of the Old Testament, the Chinese and so on.

Four was a critical number in early times, as in Egypt; *e.g.* the four elements and the four humours.[2]

Like critical numbers, days of celebration and State ceremonies also appeared to bring about their own fulfilment, lucky and unlucky; and this with a majestic procession which must have seemed to depend on some intrinsic potency.

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[1] See Rivers, *loc. cit.*; R. Crawford, on "Cramp rings," etc., *Stud. Hist. and Meth. Sci.*, Oxford, 1917; W. J. Dilling, "Girdles," *Caled. Med. Journ.*, Oct.-Jan. 1913–14.

[2] See Rivers, *FitzPat. Lect.* 1917.

Lustration in Rome, with its baptismal and holy water survivals to the present day, is a long story. Mr. Warde Fowler says the root idea of *lustrare* is *luere*—to loosen and get rid of something, primarily of hostile spirits. Certain events need certain *piacula*, and then — the trespass may be continued. Lustration contained no sense of regeneration.

Incubation; or temple sleep, long prevalent in Egypt, Greece and Rome, and not at this day extinct, was too ancient a practice to be described in these lectures as distinctively of Rome. On this practice in Greece, originally an appeal to chthonian heroes or gods, I may refer to my portion of the article on "Greek Medicine" in the Cambridge *Companion to Greek Studies*.[1] It had a long Egyptian history, and was there intimately blended with magic; certain papyri contain the details of an elaborate ritual of this kind. Dreams and their interpretation belong of course to the most ancient and universal beliefs of mankind.

In many cases of functional disorder cure by suggestion was no doubt accomplished; and of the rest many a pilgrim, awaking in the morning under the auspicious influence of the nocturnal spell, went his faithful way for a while rejoicing. As a modern historian remarks, "future patients read the thankful tablet of one who was already under the earth." At Epidaurus the priest could himself have had neither medical nor sacerdotal craft, for it would appear that he was elected from the local citizens. Yet, as we shall hardly suppose these priests, fortified presumably by a permanent staff of skilled assistants and doctors, to have been a school of accomplished impostors, honestly no doubt they attributed the cures to the god. In Cos however the Hippocratic school enjoyed such an ascendancy as to be the chief attraction for the invalids; the religious cult probably became but an adornment of the scientific. For example, in an ex voto tablet of the second century A.D. we learn that in the incubation of a young dyspeptic—M. Julius Apelles—the god gave directions as to diet (milk and honey), exercises, baths, massage of the abdomen with salt and water; and cooling applications for headache. No doubt rules of such solemnity were strictly obeyed in every detail. Yet, as I have said, to the lucid intelligence of Greece proper, and in particular to the Hippocratic schools, the ancient illusion was becoming less and less substantial. In Aristophanes (*Plutus*, 620-621 and 660 and *seq.*) we find these priests of the temple sharply satirised. For the first patient, a poor man afflicted with the *lippitudo* so curiously common in Rome, the god roughly daubs on an unguent of biting severity (and doubtful efficacy ?); while to the blind god Plutus he is far more complacent. With Panacea he wraps the head in a red[1] cloth, under which the snakes slip in and lick the eyes. For the contrast of the Greek spirit again, need I remind you of the well-known passage in the *Republic*, in which Socrates says that to regard dreams seriously is absurd, or even odious; that they are the confused and often ridiculous results of indigestion, and disappear when by temperance the soul, no longer obfuscated by gross vapours, is steady and calm. So likewise in the fourth book of the Coan treatise Περὶ διαίτης dreams are treated coldly as clinical phenomena; the Hippocratic writings, save for an occasional note of contempt, ignore all quackeries.[2] And I may point out how in Rome this lucid and positive Greek temper still prevailed in Celsus, in Galen, in "Aretaeus"—who mocks at the Temple cures, and even in Porphyry; unhappily to wane in Marcellus Empiricus of Bordeaux (first half of the fifth century, p. 381); and later in that century credulity disfigured the otherwise sober and sagacious pages of Alexander of Tralles. In Rome however, under the fair semblance of Hellenic culture, folk-lore, hierurgy, and strong undercurrents of the hungering, bewildering souls of the folk, swept on in a larger volume, gathering still grosser turbidities.

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[1] I may remind the reader also of Dr. Caton's interesting book *Temples and Ritual of Asklepios*, 1900, in which is pictured a restoration of the sleeping portico (ἄβατον) with its couches and curtains, and also of the whole Hieron. For the modern survival of the rite at Tenedos see p. 42; and for cures at Tenos, Mary Hamilton, *Greek Saints and their Festivals*, 1910. Here incubation is still practised in a church built over a miraculous well.

In primeval times *dreams* were a part of the only available theory of life; but in Rome they had sunk into the muddy waters of superstition. The Epidaurian cult probably reached Rome by direct communication; the not dissimilar rites of Isis (introduced by Augustus), of Serapis, of Osiris, were of later introduction. But incubation did not become a local and popular custom in Rome until the crisis when the augurs having failed, by the more national observances of haruspicy and *piacula*, to stay the pestilence, the Aesculapian divinity, or his emblem, was conveyed in 291 B.C. to the site on the Tiber Island now occupied by the Church of San Bartolomeo which, in the ninth century, was built on the ruins of the ancient temple.[1] Before this translation of the Aesculapian cult Roman and other foreign suppliants had been wont to seek the god in Epidaurus; and in later history, as in Herondas, we read of the continuing vitality of the cult in Cos, in 200 A.D.; of the visit of two women thither, and some description of the artistic treasures of the temple. It is said that in Greece there were eighty temples to Aesculapius.[2] Besides, incubation was practised in many other temples as well as in those of Aesculapius, and persisted in some vigour through the Middle Ages; the cloisters of St. Anthony of Padua, for example, were frequented by these incumbents, and to this day it is practised in many shrines in the Aegean. A notable medieval instance is that of Henry II. (1003–1024) who, when afflicted with the stone, attended for medical treatment at Monte Cassino. Now a Roman Emperor was an alarming and an imperative visitor; the monks therefore wisely entrusted the case to St. Bernard himself, who, in a temple dream, operated upon the august sufferer, and, if I remember right, successfully.

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[1] Red is a colour of ancient magic. Thus a red thread is a magic clew.

[2] The so-called *Epistles* of Hippocrates are, of course, apocryphal.

Both in ancient and in medieval times dreams, according to Cicero and Posidonius (*De divin.* i. 30. 64), were of three classes: the first class, of natural dreams; these the *animus* provided for itself, with no more than the cognisance of the gods; the second, of those due to the haunting of aërial spirits, in which were some "notable elements of truth" ("insignitae notae veritatis"); the third, and imperative, of those by which the gods spoke directly with men—the θεῖοι ὄνειροι of Hellenistic authors. These distinctions however were not always definite. And here it may be observed that the chthonian deities were local—parochial, so to speak, and were to be sought each in his own abode, such as a well or cave; the Olympians, being more universal, could be sought, as they might appear, anywhere.

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[1] The church contains fourteen of the original columns. Part of the site is still a hospital, of the *Fate bene* brothers. Under the altar there is an ancient sacred well. Grateful patients used to throw coins into the sacred well at the oracle of Amphiaraus at Oropus in Attica, as into many another "halliwell."

[2] Aravantinus, *Asclepios u. d. Asclepieia*: see polemic in *Janus*, xiii. 8. 444. Also review in *Bullet. de l'Acad. de Méd.*, Paris, 3rd ser., 1908, No. 25.

Thus the Epidaurian god might vouchsafe to appear to a dreamer in Rome; Marcus Aurelius seems to have been at Gaeta when the god in the dream prescribed for his haemoptysis and vertigo; and I think it was St. Gregory of Tours who appeared to a certain calculous person in a dream in St. Andrew's Church at Patras; whereupon his stone obediently clinked into a glass vessel. Dreams were of course the vehicle of counsels and prophecies of all kinds, but it was during the incubations for healing of disease that they became especially popular. Thus under the earlier and later Empire,[1] and indeed from early ages through Rome to medieval times, as we read in late Romano-Greek authors such as Aetius, and also in Christian hagiology, dream medicine and prophecy had a wide and enormous vogue in Europe down to the days of Albert the Great and Arnold of Villanova when again, by association with astrology, dreams gained a new ascendancy. Even Galen allowed himself to make use of dreams in the management of his patients. Lunatics were treated in temples or churches in this manner, chiefly by violent "suggestions." The priests leaped upon them in the dark and beat them, to expel the demon. Although Christian bishops dethroned ancient gods for later saints, such as Cosmas and Damian, or Cyrus and John, yet Aesculapius was one of the last of the gods to wane; and even then the practice survived under change of name. In Rome this method of cure (ἐγκοίμησις) gradually settled upon the lower or more ignorant classes of the people, as at the Asclepieion at the Piraeus frequented by sailors. Occasionally incubation was performed vicariously, even in ancient times, as related by Herodotus (viii. 134), by Strabo, and many later writers. To rarely favoured suppliants indeed Asclepius might extend relief, by dream simply, without the formality of ἔγκλισις.

The dream was made use of by the physician in two ways; watching the patient in sleep, he sought clinical evidence of his malady, while he practised on the belief in the method as a means of medical aid, a belief which no doubt he shared, more or less. The aid of the dream might be given either directly, as we have seen, by the hand of Apollo or Asclepius—for at Epidaurus the cults of Apollo and Asclepius were united—or indirectly by observance of certain divine commands. So strong was the tendency, especially in Rome, to categorical personifications that in many temples of Asclepius statues also to Oneiros, and to Hypnos Epidotes, have been discovered, or are recorded by Pausanias;[1] and Antoninus Pius, when in Epidauros he built a bath to Asclepius, built also a temple to the *θεοὶ ἐπιδῶται* (" the bountiful gods "). Many of the votive offerings in the Asclepieia were offered to Hypnos and to Hygeia.

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[1] *Vide* Troels-Lund, *Gesundheit v. allen Zeiten*, Leipzig, 1907.

Some dreams were verified by earthly residues; leeches were found in the couch, or a fig, or a bandage, and the like. In later times these records became more and more stupendous, especially in the Christian hagiology. Deubner tells us of a severe operation performed by Cosmas and Damian upon so reluctant a patient that Damian had to hold him fast while Cosmas applied the knife. Weinreich narrates a story of a less happy operation in which a certain saint, whose name we will not mention, put on a leg the wrong way, so that the toes pointed backwards.

It is difficult for us to transport ourselves into the enthusiasms and simple faiths or credulities of early times. But a very interesting story of the still surviving festival in the pilgrimage church of Tenos, narrated in a Lecture at Newnham by Miss Jane Harrison, in Dec. 1914, conveyed to her hearers a more vivid realisation of it (see also p. 38 note [1]). The great church, like the cloisters of Epidaurus, consists of a central block and lateral colonnades after the form of St. Peter's. These colonnades, as formerly at Epidaurus, are open-air wards, crowded with the sick pilgrims; the sanctuary of Asclepius, as it were, come again to life, or deathless. In the morning, after a prooemion of thanksgiving, was published the list of miracles (*θαύματα*). The lecturer said, " I shall never forget the scene; the utter simplicity of faith and the kissing of the hem of the priests' garments were like a scene from the gospels."

Haeser thinks that the Aesculapian worship took no deep root in Rome. It is true that authors of the earlier time are rather silent about it, and little or nothing is said of any medical skill among the priests; Galen does not mention it even to attack it; but the same might be said of the attitude of modern physicians towards our own superstitions. The silence may have been—probably was in part—contempt or indifference. " Hospes quid miras nummo curare Serapim ? " Still no doubt it drew a large share of the devotional impulse of the period, an impulse not unlike the enthusiasm of faith-healing which we are witnessing at home to-day. Its most flourishing time in Rome was probably that which immediately followed the new local foundation, before the sceptical Greek physicians flocked over to compete with their own god; nevertheless in the time of the Spanish Emperors the shrine was much frequented, and not by the vulgar only. The cult seems more or less to have supplanted that of the Dea Febris, Mephitica, etc. And the temple had some privilege of asylum: if a master refused to treat the disease of his slave, and the slave, making his way to the island, was cured there, he became *ipso facto* legally free. Marcus Aurelius founded a *hospitium* rather than a hospital, probably as an annexe to the sleeping portico;[1] and a large, and it is supposed valuable, library and *armamentarium* were gathered there. After this manner the temples developed into sanatoriums (see *Linacre Lect.* p. 462), and extant instruments suggest that some rational therapeutics at least were in use. The records, or testimonials, however had probably no scientific value; indeed the value of those of Epidaurus, though possibly higher, has been much exaggerated. The legend that the Hippocratic medicine grew out of the temple practice and records is discredited.[2]

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[1] *Vide*, for example, Paus. ii. 10. 3.

The *votive offerings* (*donaria*, ex-votos) were not merely commemorative; they were often deposited in order that there should be no divine mistake about the organ to be repaired. Thus, images of eyes, ears, and limbs, and of viscera, singly or in groups —the inwards probably copied from sacrificial animals—were offered, as still they are offered abundantly to this day.[3] Many of these date from Etruscan times; *e.g.* a bronze liver found at Piacenza, and an alabaster liver from Volterra. A very old Babylonian specimen seems to have been copied from a sheep's liver. A "Votivbild" apparently of a case of phthisis, and a representation on a Greek vase of a "policlinic" for rheumatic and gouty patients, are described by Kronfeld.[1] At Palaeocastro (Crete) votive figures of arms and legs, heads, genitalia, etc. are found which probably date back to the second millennium B.C. In the Asclepian sanctuary on the south slope of the Acropolis (in the historical period) 92 reliefs and 13 inscriptions have been discovered, but not to Asclepius only; also to Hygeia, Demeter, Machaon, Kore. Here again secular instruments, such as catheters, were found with them. The peculiar golden offering of the Philistines recorded in the sixth chapter of the First Book of Samuel comes here to our minds. In the Savile Collection in the Nottingham Museum is a terra-cotta from the Nemi temple of a woman with the thorax laid open so as to exhibit its viscera (No. 131 in the Wallis Catalogue); it is attributed to a period between 300 and 150 B.C. Effigies in terra-cotta of eyes, ears, and other limbs are dug up in modern exploration by the bushel. The votive offering which has perhaps the most ancient, certainly the most curious, history is the effigy of the uterus. From times beyond date, *e.g.* in the Ebert papyrus, this viscus has been regarded as an animal endowed with independent life and motion, and as using its faculties to course over the inward parts. It was customary in Hippocratic times to use both abdominal palpation and vaginal inspection to ascertain its temporary habitat. This kind of *donarium*, found not in Southern Europe only but also of northern provenance, as may be seen in the Nuremberg Museum and in not a few Roman Catholic churches of the north, was usually made of metal—of iron or lead; or perhaps I should say that those made of metal have not perished. In form it was various; usually a quadrupedal tortoise-like creature, but sometimes newt-like in shape, or even crocodilian. Soranus and Galen both combated this legend; but Aretaeus (ii. xi.) said that the womb "closely resembled an animal (*ἄγχιστα ζωῶδες . . . οἰκεῖόν τι ζῶον ἐν ζώῳ*), for it moves itself hither and thither, etc. (*πάντῃ ἐστι πλανώδης*). It runs after certain odours, and flies from others." Paul of Egina, in "suffocation" (πνίξ) and hysterical convulsion, speaks of fragrant ointments passed into the vagina to draw back the uterus to its place; and of stinks to the nose (*e.g.* valerian) to drive it homewards. Speaking generally, these objects are of little or no value in the history of anatomy.

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[1] So the Aesculapian asylum, founded A.D. 154 on the Appian Way, was not an hospital but what we should call an almshouse.

[2] The relative place of temple practice in the evolution of ancient medicine, and the proportions of miracle to professional and rational methods, are really unknown. This question I have dealt with elsewhere. M. Cavvadias, with whom I once incidentally discussed the subject, seems, or did seem, to me to lay too much stress—or more stress than medically instructed historians would be disposed to do, on the temple as the source of Greek medicine (*vide* Τὸ Ἱερὸν τοῦ Ἀσκληπιοῦ, Athens, 1900). To speak, as some modern historians speak, of Asclepius as only a great physician glorified, is mere guesswork. In Homer he is indeed spoken of as the father of Podaleirios and Machaon, Paean being the god of medicine; but at any rate in the Homeric hymns (say 500 B.C.) he was a god—*θεὸν καὶ ἰητῆρα νόσων.*

[3] *Vide* Art. "Donarium," by Homolle, in Daremberg et Saglio, *Dict. des Ant.*, 1892; *Altitalische Weihgeschichte*; Stieda, *Röm. Mitthl.* xiv. 1910; Dupouy, *Méd. et mœurs de l'ancienne Rome*; Lanciani, *Pagan and Christian Rome*; and Meyer-Steineg's description of his own ex-votos—including one of facial palsy, one of sarcoma of the orbit in a boy, etc., *Jenaer med.-hist. Beiträge*, H. 2. Also Dr. Rouse's *Greek Votive Offerings*, 1902.

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[1] In the *Wien. med. Wochenschr.*, No. 39, 1910.

Defixiones were the opposite of votive offerings; they might be called votive curses, such as to root ("defigere") the enemy to the ground (with fear), *defixum imprecatione.* Such are the imprecatory cuneiform tablets of Mesopotamia; and such, in Greece, Asia Minor, and Egypt, the *tabellae defixionum* (in the British Museum and elsewhere). The accursed was to be made the victim of a fever, "quartana te teneat"; or some organ of his—liver, limb, bowels, eyes, etc.—to be injured.[1]

The Snake.—In the Dream the god might appear personally in his "noble manly beauty," sometimes accompanied by his daughter Panacea; or in the shape of an attribute. Thus Asclepius would appear with a snake, or as a snake:

> Vertar in hunc, sed maior ero, tantusque videbor
> In quantum verti caelestia corpora debent.
>
> OVID, *Met.* xv. 661.

I may be changed into this, but shall be visible in a magnitude as vast as befits the transformations of celestial beings.

It was in the form of a snake that, to avert a plague which had proved to be beyond human skill, after opening the Sibylline books and consulting the Delphic oracle, he, or some of him, was conveyed to the Tiber Island, with the oracular precaution and processional pomp which in all times have accompanied the removal of a shrine; as in the travels of the ark of Moses, of Serapis, and so forth. Ἄγειν ἐφ' ἅρματος was the formal phrase of it.[2] Thus was the cult of Asclepius carried to Athens in 420 B.C. And it is no less well known, not from the Old Testament only, how terrible a punishment might fall upon one so unlucky as to err in any point of the ritual; for, although our concern is for the moment with the beneficence of the gods, yet in every degree, from mere aversion of the countenance, to vengeance not only upon the sinner or scoffer but also upon the hapless blunderer, their maleficence was at least as notorious.

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[1] See F. B. Jevons, "Defixionum tabellae," *Trans. Third Internat. Congr. Hist. Religions*, Oxford, 1908, ii. 131 ff., a reference I owe to Mr. B. Cook. The nails driven into the Hindenburg statue suggest those on which the votive offerings were suspended; as the driving of a nail into the Temple of Jupiter?

[2] Or ἐφ' ἁμάξας; *vide* Benson, *Class. Rev.* vii. 185, who refers to Pausanias (ii. 10. 3).

The snake itself from the earliest times, it is said from palaeolithic times, has been regarded as an object of worship, and later as the symbol of healing; possibly from its "chthonic" (or phallic, seminal, *ἀλεξίκακος*) associations (Weinreich); or as a living circle, the emblem of eternity; or perhaps on account of its long life and the sloughings and regenerations of its skin; or again, according to a scholiast of Aristophanes, because of its quick sight (*δράκων = δέρκω, ὅ ἐστι βλέπω. ὀξυδερκὲς γὰρ τὸ ζῶον*). In the vases of Cyprus and Caere of the seventh century it appears with religious and daemonic attributes. When Hadrian completed the temple of Zeus Olympios at Athens he dedicated therein a snake fetched from India. The associations, or even identity, of the snake with Greek deities, especially the chthonian, are indeed manifold. Asclepius, a chthonic god, was translated to heaven as the constellation "serpent-holder," and the god and his stars were often identified. Cecrops was a snake-king, and was figured with a snake's tail. The King and the Healer were then of course one. The name Asclepius is said to signify the Creeper, one who walks by rolling round and round (deriv. Fick: *ἀσκαλαπάζειν = ῥέμβομαι*);[1] *ἀσκάλαβος* is a spotted lizard. The chthonic nature of the snake is well attested by its association with caves, and so with the souls of heroes and ancestors; and with waters and wells, as illustrated by Robertson Smith in the *Religion of the Semites*, and by Sir J. G. Frazer in his *Pausanias*, and in the *Adonis, Attis and Osiris* of the *Golden Bough*. Weinreich however is disposed to think that the association may have been more or less indirect, as waters of healing would be under the patronage of Asclepius and his snake.[2] In some tribes of northern Greece—Celtic, Thraco-Illyrian—Apollo Grannus was a god of healing waters.[3] The mystical confusion between Asclepius as a snake and with snakes, a confusion or transition typical of all these early emblems (p. 353), had its conveniences, as we read in the legend of the Tiber Island. The wily priests of Epidaurus, in consenting to part with the snake, " reserved " the question of a bestowal of the very God himself; while in his turn the Roman ambassador maintained a contrary " reserve " towards the Roman people.

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[1] For this derivation I am indebted to Miss Jane Harrison.

[2] The species was ordinarily *Coluber aesculapii*; it measures from 125 to 190 cm. in length. Habitat S. Europe, up to Taunus, Thuringia, and Hertz. Schlangenbad is said to owe its name to this reptile.

[3] MacCurdy, *Class. Rev.*, Dec. 1912.

Strong evidence not only of the persistence but also of the increasing influence of the Asclepian cult in Rome under the Empire is the development therein of new qualities, such as are to be noted on the testimony of no less a witness than Galen, who in a remarkable passage speaks of *ὁ πάτριος θεὸς Ἀσκληπιός* as the patron of song and drama which warm the blood; and also, for the like advantages of health, of military and other gymnastics, and of riding and hunting. Weinreich quotes an apt passage from Iamblichus,[1] who speaks of the many such wholesome methods and inventions of the god. Ritter v. Rittershain (*Med. Wunderglaube u. d. Inkubation*) also speaks of the Asclepius of this period as " Vater der Heilgymnastik "; and, whether by miracle or by the advance of the more rational methods of counsel and ordinance, we proceed from these dreams, visions, and messages, to similar communications with persons wide awake; though still perhaps suppliants in the temple. As however there is no distinct line between the two modes, and no considerable difference of kind, I need not do more than point out this development of temple medicine. As we have seen by the quotation from Galen, this transition was a note of the underlying tendency to more rational and less superstitious habits and conceptions; although among the baser people the old folk methods were still flourishing abundantly. Mr. W. H. S. Jones, in his well-known studies of malaria in history, is disposed to think that as malaria became endemic the vogue of dream-oracles and other charms became intensified, even among the cultured classes; nevertheless Asclepius became in part more and more associated with higher culture: and although it is true that not only his soldiery, but also Marcus Aurelius himself, not only the plebs, but also the aristocracy, still sought the shrine of the Tiber Island or of Epidaurus, yet for the more enlightened of his suppliants at any rate the curative methods (Iamata) both in feature and content were becoming more rational. Besides the extant inscriptions, which betray a more trivial, and so a more individual note, with less of priestly editing, we have the evidences of the *ἱεροὶ λόγοι* of Aelius Aristides, which, scattered through the literature of the age, have been studied by Wilamowitz[1] and other commentators; and in them Asclepius now appears less and less as the magician and "Wonder-Surgeon" of the old Iamata, more and more as an oracular adviser. It is notable too that fewer and fewer suppliants are seeking him for overt injuries, such as wounds by weapons, blindness, and so forth; more of them are neurasthenical persons and those enervated or disordered by gluttony and luxury. Furthermore, between Apollo and Asclepius the qualities of *μάντις* (prophet or seer) and *ἰατρός* (physician) were becoming differentiated; as a like modification, both in the kinds of patient, of therapeutical virtues, and of cure, is to be observed in the histories of Gregory of Tours and other medieval wonder-workers. Thus, even in the pre-Christian Empire, we find less and less of the amazing operations and magical extempore restorations of earlier times. We learn indeed from Pausanias (x. 32. 13), at a later date, that in the Isis temples cures began to be restricted to invited cases (*οὓς ἂν αὐτὴ προτιμήσασα ἥ Ἶσις καλέσῃ*). Moreover cures began to take time, and to be compassed by natural means, however grotesque. For instance, to one sufferer is prescribed *κόκκοι στροβίλου*; to another a collyrium made of the blood of a white cock mixed with honey. Not only so, but with Hellenistic influences we find a very interesting advance in the perception of the effect of the *ψυχή* upon the *σῶμα*, so that again, as in the best Epidaurian period, cures were wrought by the arts of music and the drama, and by other psychic refreshments. Moreover the notion of suffering as a purificatory discipline or atonement becomes perceptible. On the other hand some of the means of healing seem to have had their origin in old taboos; as in the prescription, apparently malicious, of swine's flesh for the sicknesses of Jews and Syrians;[2] and this not by Asclepius only, but also by Cosmas and Damian (Deubner, *loc. cit.*), Cyrus and John (Migne), and other magical healers who succeeded the god in his functions. Some modern commentators go farther and read into certain of such legends meanings of an allegorical or sub-allegorical kind. It is but fair to the memory of the Christian saints to declare that pagan legends of cures, too often of a loathsome kind, were largely carried to their discredit by the undercurrents of folk-lore. Weinreich attributes the flocking of the sick to the shrines of Asclepius, of Serapis, and of Isis, whose cults made their way into Rome by their healing attributes,[1] and the stories of Apollonius of Tyana in the reign of Titus, to a progressive decay of the medical profession; an opinion which, as concerning the generation of Galen at any rate, seems to be imperfectly justified. *In Tiberim defluxit Orontes* — the influence of the East had poured into the West.

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[1] *De myst.* iii. 3. 708; (Parthey) quoted Weinreich.

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[1] *Isyllos von Epidauros*, p. 116, etc.

[2] *Vide* for example Robertson Smith, *History of Semites.*

Even favourite animals, for sickness or injury, were brought before these temples, as many votive offerings in the Tiber temple of Asclepius testify (Besnier, *loc. cit.*). A similar broadening both of medical and humane conceptions marked also, as we gather from Philostratus, the miracles of Apollonius; and the animal stories of the Pythagorean tradition were thus propagated to the times of Cosmas and Damian, who cured all diseases, not in men only, *ἀλλὰ καὶ κτήνεσι* (but also in the cattle. Migne *in loc.*). And thus we are led to think of St. Jerome with his lion which, as in Carpaccio's picture, so innocently disconcerted the monks; and, again, the beautiful story of St. Francis and "brother-wolf." This sympathy with the animal creation (*ἄλογα ζῶα*, or *θεοφιλῆ ζῶα*), that we cannot attribute exclusively to the Northern races of Europe, grew up under Stoic influence. Chrysippus the Stoic extended *προνοία* (divine providence) to all animals (Cic. *De nat. deorum*, ii. 64); and Weinreich says that the same tenderness for animals is to be found in Philo. Thus before the Christian times, out of divine healing, and in the following of Chrysippus, arose a large "Providence (*προνοία*)-literature," which was distinctly Stoical, as contrasted with Epicurean, and made its way into the current essays of morality and edification. Besides, by degrees even in pre-Christian times the idea of divine providence was detaching itself from particular deities; Asclepius was eminently an embodiment of *προνοία*. Indeed in many temple cures the divine aid is made dependent upon recantation of Epicurean atheism and *ἀκολασία*, and burning of the master's books (*vide* Lucian, *Alex.* ch. 47). That such zeal should have inflamed that august incendiary Gregory the Great, and some of his humbler successors, is one of the calamities of history.

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[1] As recorded by Tacitus (*Hist.* iv. 81), Suetonius (*Vesp.* 7) and Cassius Dio (lxvi 8).

To enter into the chapter of the healing properties of *waters*, *baths*, and *holy wells*, would need a large excursion ; but, as they played a great part in Latin medicine, I must not fail to call them to your remembrance. In them chthonic gods naturally had their abodes ; and to them, as to the temple shrines, votive offerings were made, and indeed are still made in the form of the pins, rags, small coin, or shells which many of us have seen in and around holy wells at this day.

Considerable as was the part of *Talismans* (τελέσματα), in which one may include magic pictures, idols, palladia, and emblems—such even as some of the sillier of our people buy this day in Bond Street, yet I must not detain you on so familiar a part of the subject. In Southern Europe we still see statues and pictures of benefactors as worshipped, receiving votive offerings, or gilded or enamelled with gems ; as in S. Antonio's temple at Padua, in Naples, and even more splendidly in modern Greek churches. In popular idea the conception of deity became condensed from the abstract into the image ; so that by his god the worshipper actually meant the image itself :

> κοινόν δὲ λόγον ἔχουσιν οἱ θεοὶ καὶ τὰ ἀγάλματα αὐτῶν.
>
> Artemidorus, *Oneir.*, quoted Weinreich.

If we may believe Lucian, such effigies, if neglected, would at times, like the ivory Hippocrates which belonged to the physician Antigonus, make themselves extremely disagreeable ; even so far as to take to what undergraduates call "ragging" expeditions. That angry image, when annoyed, not only walked the house of a night, banging the doors, but was so far transported as "to make hay" in the medicine chests. It is no matter for surprise then, as we learn from Pausanias (for example, vi. 11) and from Lucian, that such potent effigies were especially trusted for the cure and warding off of fever ; and thus, by the direction of oracles, or for expiation, statues were erected to stay or prevent epidemics. Plutarch tells us that Sulla carried about a golden image of Apollo as a talisman.[1] Even in Christian apologetics these wonders were not so much called into question as attributed to demons, the demiurges who, as Plato said, ministered to God in the creation of the world; and two hundred years after Christ Apollo had still his suppliants against the plague. At this day indeed in the Tyrol small stamp-like pictures of the Madonna (ἡ παναγία—*Bona Dea—Dea Mater*) are sold in the streets and, according to the severity of his case, the suppliant tears off and swallows the proportionate number of them. Again, in incubation the god Asclepius, or Serapis for example, would appear frequently as a statue, or in a grotesquer shape, extending his aid ὥσπερ κάθηται τῷ σχήματι (Deubner). Marcus Aurelius thus invoked, and saw, Asclepius. Comparetti, in his interesting book on Virgil, compares his fame as a magician with that strange Byzantine prophet Apollonius of Tyana, with whom indeed in the Middle Ages his name was often coupled. In the *Golden Bough*, Sir J. G. Frazer points out that Moses' Brazen Serpent was a talisman;[1] and often, on the ancient magical notion of "similia similibus," the very means of hurt becomes the means of healing; as the mouse was a talisman against plague, golden "emerods" against buboes (?), crabs against ulcers, verminous emblems against plagues of vermin, the yellow plover against jaundice, a spider necklace to extract spitefulness, and so forth. Many such instances and practices can be found in Pliny and in later, even medical, authors, such as Alexander of Tralles who had a profound belief in the efficacy of magical recipes, amulets —even in the form of living animals, and other "φυσικά." Gold, as we have been learning anew in the *Ring of the Nibelungen*, is a chthonic treasure and magical; it was used therefore for rings and other emblems against diseases and misfortunes.

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[1] The association of Apollo (Smintheus = of the *mouse*) with the plague is a very ancient and remarkable belief (*vide* Homer, *Il.* A).

Palladia, from sacred stones to the image of Athene, the stone of Scone, and the Luck of Eden Hall, abounded among all peoples; some under taboo, like the Ark, some, like many Romanist relics, exposed to view. The healing stone of Mecca is well known; it is said that the Ark contained such a stone.

The doctrine of *Signatures* is too familiar to need more than a passing allusion. As of Omens, that of Signatures was tentatively scientific, though of incredible *naïveté*. The *Geister der Pflanzen*,[2] it declared, were revealed by forms or marks. This plant—euphrasy, for instance—has the form of the eye; that resembles the ear, that the tongue; and each has virtues corresponding to its sign. Yellow flowers, such as the celandine, are good for jaundice; another plant, being like a snake, is accordingly poisonous; again another, having the marks of a snake on its leaf, is an antidote to venom. In this, as in many other modes of fanciful symbolism, the clews are often lost; we cannot tell how or whence the notions originated, or if indeed they sprang independently from the fundamentally similar minds of several races of mankind in several places. As in the beliefs in magical or critical *Numbers*, whether in the many nations and schools they originated severally and independently, or were propagated by intercourse, no one can now say.

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[1] See also Robertson Smith, *loc. cit.*

[2] Schlander, *Aberglaube des Mittelalters*, Breslau, 1858.

Analogy and Sympathy.—Analogy must predominate in man's reasoning before he is trained to search for affinities in deeper resemblances, and before he possesses a body of knowledge. Even in later times analogies come only too readily to save us the trouble of hard thinking and of testing. The doctrine of Signatures is an eminent case of the analogy conceit. Analogy was strictly an imperfect logic, whereas Sympathy, speaking as strictly, consisted in a mystic transfer of some virtue. Still in particular instances it is not always easy to distinguish the two ideas. When Lucretius argued from dust in the sunbeam to the atomic constitution of matter (ii. 113), or when Heraclitus, with infinite effect, assimilated the living principle to wine and its spirituous vapour, they argued by analogy. One example, a curious but not very strange instance of this source of error, may suffice; namely, the analogy of St. Augustine when he says that the forty-six years spent on building the Temple meant the forty-six days required for the embryo to form within the womb.[1] But the Greek, even in his errors, was preserved from extravagance by his sense of proportion. In our own times, if in the sphere of science we have learnt better, and do not apply the methods of one kind of problems to those of a different kind, yet in the sphere of the fine arts, for which our aptitudes are less, we fall continually into the errors of analogy: we impute to one art the conditions of another; we carry into sculpture the conditions of painting, into painting the conditions of history or romance, into music the conditions of epic poetry, and so forth.

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[1] *De divers. quaest.* lvi., *De Trini.* v. 4, and *De doct. Christ.* ii. 28. This quotation I owe to the Rev. H. F. Stewart of Trinity College, who thinks that Augustine did *not* derive it from Aristotle (*Hist. an.* vii. 3).

Sympathy, the transference of a virtue from one agent to another, is then a distinct idea. In Pliny, Virgil, Juvenal, we have abundant examples of this curious but popular notion in medicine, many probably taken from Cato's *Commentarium* (p. 61). From early times down to the Middle Ages, the dreads of impotence and sterility were a nightmare, so that the means of averting or curing the evil were many; and, when regarded in the light of the gravity and good faith of the performers, these cures by analogy had not the loathsome nakedness in which, even in authors so chastened as Virgil,[1] they appear to us. However, passing these by, as a more convenient instance I may quote that of the swallow. This bird was supposed to be, of all animals, the acutest in vision, and its eyes to be either invulnerable or capable of regeneration after injury. Accordingly, by the witness of Graeco-Roman physicians, from Celsus (vi. 6) to Paul, and probably long afterwards, swallow's eyes roasted and pounded into a salve, or swallow's blood similarly prepared, were used as a sovran remedy by the oculists. Again, as the blood was always regarded as the fountain of life, to drink the blood of a warrior, or still better to eat his raw heart, was to transfer his bravery therewith to the consumer. But, as human hearts were not often available, the heart of a bold beast, as of the lion, was regarded as not much less efficacious. I have read somewhere a quotation from a chronicler, Cedrenus, a Greek monk of the eleventh century, saying that the physician who dissected Cyril cut off and ate the holy episcopal liver; that in consequence his tongue sloughed off ended this story with a dramatic fitness. Of many more such examples I may mention this also, that the blood of a chamois was drunk to cure vertigo.[2] Thus a craving of decadent men for vicarious or transferable virtues led to hideous abuses; to the procuring of the blood of virgins of either sex, or of children, as in the infamous story of the medical sorcerer who, so it was rumoured in the chronicles of the time, sought to cure the nervous disease of Innocent VIII. with the blood of three pure children.

Astrology, that most ancient of Asian mysteries,[3] made no great way in Greece; but though Rome did not owe this superstition to Greece, nor to her Greek physicians, it entered so largely into Roman life and belief that we cannot wholly pass it by. It is another note of the scientific and rational character of the Greek—of the classical Greek at any rate—that, cognisant as he was of the ancient and imposing phantasies of astrology, as distinguished from primitive meteorology, he ignored, and even —as by Eudoxus for example—repudiated them. Yet they were all around him; indeed from Babylon he had accepted the knowledge of the ecliptic, of the Zodiac, and of some of the planets.[1] Even Sextus Empiricus denounced the astrologers, though this denunciation was but a chapter of his attack upon the "Mathematici"; I fear he rejected astrology only as he rejected all scientific and philosophical hypothesis. Speaking generally then, and omitting occasional doubts, as possibly in Pythagoras, and allusions, as even in Plato and Aristotle, the Greeks of the classical and earlier Alexandrine period, from the Ionian conception of the spherical earth and the sober meteorology of Hippocrates, to the rational astronomy of Eudoxus, Aristarchus, and Hipparchus, constructed their own independent astronomical evidence on a mathematical basis. If in the *De aëribus*, in respect of the behaviour of Arcturus and the setting of the Dog-star, it found some slight countenance, in the Hippocratean treatise on Ancient Medicine astrology is vigorously denounced. Such was the main line of the great tradition through Aristarchus and Ptolemy to Copernicus. The Greek of those centuries was never a "Chaldaean."

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[1] See *Georg.* iii. 280; and Juvenal, vi. 133.

[2] The fear or use of blood, especially of the ox, as a poison (*vide* Herodotus iii. 15) is another and different notion.

[3] See Troels-Lund (*loc. cit.*); I would refer also to a paper on "L'Influence religieuse de l'astrologie dans le monde antique," by Franz Courmont of Ghent; it was read at the Oxford Congress of the History of Religions, 1908.

We may presume then, from Celsus and from their own writings, that the immigrant Greek physicians, and Greek medical books, did not bring astrology into Rome, nor even countenance it. Possibly introduced by the Etruscans, but more copiously by the tides of oriental superstition and phantasy which began to flow into Rome, in and from the second century B.C., after the time of Diocles, astrology among this credulous, fatalist, and intellectually obtuse people found a fertile soil. In the words of Tacitus "*vetabitur semper et retinebitur.*" In the third century it is said that Berosus, a priest of Bel in Babylon, introduced astrology into Cos, whence also it spread rapidly over Europe. Egypt was a hotbed of such dreams and chimaeras, and Petosiris, an Egyptian priest, who lived a little later, about 150 B.C., generally associated in history with one Nechepsos, an Egyptian king, attained to such a prestige that, as readers of Juvenal will remember, his name, as likewise in the instance of William Lilly, attained to a generic notoriety, and became as general a name for an astrologer as Cocker for arithmetic. Petosiris and Nechepsos are said to have been the first experts to cast nativities. Of their high repute one may read in Manetho. The poem of Manilius, of the time of Augustus, is a mixture of astronomy and astrology. Tiberius regarded astrology with some favour; then, with the indraught of Mithraic, Gnostic, Neo-platonic, and other oriental religions and philosophies, astrology in the third and fourth centuries A.D. bloomed in the Hermetic books, and throve later in the gross superstitions of the Middle Ages. That indeed medicine did not wholly escape the infection, a cursory glance at the first volume of Ideler, at the profusion of astrological signs in the "iatro-mathematical" treatises (pp. 387-96) will testify. But happily astrology did not seriously infect the medicine or the Greek physicians of the period with which these lectures are concerned.[1] The "Chaldaeans" were banished from Rome in A.D. 179. Indeed even in early Rome astrology seems to me to have been less prevalent than other false doctrines, superstitions, and sorceries. We have, it is true, the well-known passage of

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[1] I hardly agree with Prof. G. Murray (*Four Stages, etc.*) that astrology fell upon the Hellenic mind as a new disease falls upon some remote island people. The Greek was long familiar with most kinds of oriental flightiness. With the relations of Crete and its art to astrology I am not here concerned.

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[1] I have made no research into the history of astrology; in itself it is a sterile subject. I am indebted to an article by Franz Boll in the *Neue Jahrbücher f. d. klass. Alt.* xxi., 1908, to cursory glances into Manilius, and into Bouché-Leclerq's *L'Astrologie grecque*. The unfinished poem of Manilius contains not a few fine passages, such as this, quoted by Goethe, which led me to dip into the book:

> Quis coelum possit nisi coeli munere nosse
> Et reperire deum nisi qui pars ipse deorum est?

See also Dr. Mercier's FitzPatrick Lecture on Astrology in 1914? The following extract from a letter of our late Fellow, Dr. J. H. Bridges, is remarkable. In acknowledging a copy of my *Harveian Oration* of 1901, he says, "I feel tempted to say a word in defence, not of astrology, but of medieval belief in it; as I have done in my edition of Roger Bacon (vol. i. pp. lx-lxv). The passages cited there show this clearly, I think, that Aquinas, no less than Roger Bacon and Dante, believed in the influence of the planets on human desires and passions. Only they maintained that the will was strong enough to withstand their warping influence, *if exerted*. I think that so long as the Ptolemaic system held sway astrology was a most rational hypothesis." Cumont's book, which I have not seen, is probably the chief authority. Nevertheless, much of interest to medicine and other sciences and to history must be contained in the half-explored wilderness of old astrological writings: *vide Cat. Cod. Astrologorum Graecorum*, which I have not consulted.

Pliny before us, where he speaks of Crinas of Marseilles who, besides ordinary medical means, observed the courses and positions of the heavenly bodies, ordering days and hours by almanacks and ephemerides, "as if he commanded all our destinies"; and the sober Aretaeus (see p. 276), in the latter part of the first century, supposed that the Pleiades produced tides in disease, no very unscientific notion. Moreover astrology made some farther advances under the Empire, acute diseases being referred to the Moon, and chronic to the Sun, and Sudhoff considers that Galen, in his tract on Critical Days,[1] gave astrology a great material lift; yet, speaking generally, I think Galen cannot be regarded as a propagator or entertainer of this imposture, this "instrument of positive nescience," as Prof. Burnet calls it. However, it is true that he rebukes a certain school of thinkers because they despised dreams, birds, omens, and the whole of astrology (*De nat. fac.* i. 12). In the West the great outbreak of astrology, and of sorcery white and black, was deferred to the thirteenth and later centuries, when it was kindled or fanned by the Arabs and Frederick II., by Arnold of Villanova, and Peter of Abano. The belief in this later period, that not the several limbs and viscera only, but even the hair of the head and the nails of the toes, were under the punctilious rule of the stars, was independent of the tradition of Galen, or of any others of the professors of Graeco-Roman medicine, regular or irregular. Alchemy, although often published under great names of antiquity, as of Democritus, is nearly all of it later than Greek.

Around these gropings after knowledge, besides these and other faithful practices of illusory methods which move our sympathy and prevent our rebuke, stealthily but in dark volume poured in the miasm of *charlatanry*. Theurgic medicine, as we have seen, was at least some protection against the charlatanry which captured only too readily the childlike methods of folk-lore; we must distinguish between the rustic simplicity of the old Roman religion and the corrupt and lustful superstitions of the Empire. But the populace is always too ready to gamble for the profits of service without its discipline and its price. Even in the best Hippocratic period we read of quacks collecting crowds and using vulgar deceits. In the Περὶ *εὐσχημοσύνης* and in the Π*αραγγελίαι* by the side of earnest counsel to high-mindedness and intellectual sincerity—pleading even for those wicked men, the fickle folk who change their doctors, as *ἄξιοι μὲν ἀμελίης οὐ μέντοι γε κολασίης* ("who deserve neglect if indeed not punishment")—we read of the base and ignorant pretenders who cannot or will not comprehend such maxims but, dressing gorgeously and blowing trumpets, plunder the rich, yet leaving them in evil case.[1] And would this were all. If such things were done even in Greece, in Rome not only was the art of medicine thus degraded in manners, but it was dragged into far deeper and fouler mire. Without assailing your ears with scandals of black intrigue and monstrous crime, it is but too certain that not the blatant quack only but even physicians of repute connived at and even conspired in the basest infamies. In the Rome of which we are speaking, there was no standard of qualification: in the words of Scribonius Largus, "Quisque volens faciat medicinam." Physicians, at any rate down to the Empire, were not a professional body, scarcely a specific group; they mixed, a motley gang, in a world of all shades and confusions—"*augur, schoenobates, medicus, magus*," good and bad, instructed and uninstructed, freemen and slaves, reputable and disreputable, straight and crooked, honest and profligate; some loyal and gentle, others sycophantic, avaricious and treacherous. Of such a crew it is impossible to strike an average, and the Greek adventurer, intellectual as he was, was too often an intriguing rascal. Galen said ironically that he was silly if in the race for applause and gain he wasted his time on learning. Thus the public was bewildered, and in the eyes, not of satirists and gossips only, medicine was brought into hatred or contempt. Satires and plays of public manners, overcharged as they may be, if not fairly life-like lose their point; we have only too much sober evidence of the complicity of physicians in such practices as suppression of births, infanticide, and even murder of adults by poison, to regard the public gibes of Plautus as, even in that early time of Rome, extravagantly calumnious. When Plautus puts into the mouth of the handmaid Astaphium "Ne sibi persuaderes Ut abortioni operam daret, puerumque ut enecaret," the threat was presumably taken as a matter of course; though we may add that it was made in respect of a midwife. And it cannot be said that these and such crimes, explicitly forbidden by Hippocrates, prevailed only in a semi-barbarous period of old Rome; with the corruptions of wealth and social profligacy they became more and more frequent and shameless. Before this audience I need but allude to the reprobate Eudemus, brought at last to torture and the gallows, the fellow paramour with Sejanus of Livia, and the poisoner of Drusus whose death was one of the unluckiest mishaps of history; or to Vettius Valens, physician to the abject Claudius, and parasite of Messalina, a wretch who also came to the bad end he merited; or to the greedy boaster and no less wicked and adulterous scoundrel, Stertinius Xenophon of Cos, who aided Messalina to poison Claudius; or, of a lesser order of turpitude, to the swaggering impostor, Thessalus, and his like (*per contra* see p. 200). The huge fortunes left by these medical adventurers, fortunes estimated in scores of millions of sesterces, whatever these sums may mean to us, speak not only of the unscrupulous rapacity of Greeklings who hied to Rome to shake the pagoda tree, but also of the ill-gotten spoils and bloating diseases of their patrons. In venality there was not much to choose perhaps between Vettius and his like and Crassus "the great slum landlord." Yet, while such evil men were flourishing, physicians of modest mien and honest kindly nature, men moreover of skill and resource, if less notorious were by no means wanting; such men as Antonius Musa, to whose merits as the able physician of Augustus and the friend of Virgil,[1] Horace, and Maecenas we have the testimony of Galen; or such as Meges, of whom Celsus speaks as "the very wise," the best pupil of Themison, the first to reduce a forward luxation of the knee,[2] and to describe carefully certain scrofulous conditions. Of the esteem and affection in which many such honourable and skilful physicians were held we have ample warrant in contemporary authors, as for instance in Cicero and Seneca. Seneca has left us a beautiful portrait of his own physician, of whom he gracefully says, "*pretium operae solvitur, animi debetur.*" Perhaps it was during the period of the Spanish emperors, if we may rely on Galen himself, Plutarch, Pliny the Younger, and Dion Cassius, that, superstitious as the period still was, physicians stood highest for probity, skill, and beneficence. By such authors as these many physicians, to us now but *nominum umbrae*, are mentioned with honour and affection.

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[1] "Zur Gesch. d. Lehre v. d. kritischen Tagen im Krankheitsverlaufe," *Wiener med. Woch.*, 1902.

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[1] Wherein we are reminded of the charlatan doctors of the *Spectator*, who rode in gilt coaches and dined off gold plate.

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[1] It has been cogently argued that *Musa* was the *Iapyx* of Virgil.

[2] Professor Howard Marsh showed me that what was meant in this passage was a forcing forwards of the tibia in relation to the lower end of the femur, a condition he had seen only twice.

In the midst of the welter, towering above all, as great monuments above turbid and devouring floods, as beacons for their own age and for all ages, stood, and yet stand, the great figures of Asclepiades, Archigenes, Soranus, and Galen, in fame unequal, but in the gifts of Nature not unequal. Of these great men I shall speak in another lecture.

CHAPTER III[1]

EARLY ROMAN MEDICINE

This summary of the theurgic and magical elements in Roman medicine, slight as it is, and many as are the curious details I shall have to omit, may serve for the moment to suggest in its lights and shadows the true characters of Roman medicine. Now with your permission I will step back to take up my story again with the household and folk medicine: and particularly with the practice of Cato the Elder. As common experience tells us, the more remote and secluded the society the more freely domestic medicine flourishes. In the agricultural and pastoral provinces of Scotland, where journeys were long and toilsome, the service of the housewife's medicine closet was very busy. The lairds and their wives "doctored and drenched themselves and their dependents with all sorts of strange and wonderful decoctions," mixed according to manuscript collections of recipes handed down from generations beyond memory. And in the English counties this self-reliance was not much less, especially among those of the gentry who rarely travelled far from home.[2] I remember hearing that the great sportsman, Mr. Meynell, to get rid of the gout for a hunting day, would take on his own counsel two strong calomel pills and a teaspoonful of colchicum wine in a glass of hot gin and water; while the only stimulant he took with him in his flask was tincture of rhubarb. It is in some such light as this that we must regard the medicine of Cato—as one of the many arts and home industries which in early societies were not yet differentiated. Though not noble, yet probably of old Sabine stock, Cato, by his rude honesty, energy, strength, and austere ascendancy—*ferrei prope corporis et animi*, as Cicero says in the *De senectute*—rose from quaestor to be aedile, praetor, consul, and censor. Like nearly all the old Romans, and like many Swiss landowners down to our own day, before the importation of Sicilian and foreign grain, and presumably before the introduction of malaria, he "tilled his own lands with his own hands." Now we learn from Pliny that Cato practised medicine by the guidance of a certain *Commentarium*, or traditional recipe book in many chapters; it was extant in Pliny's time (*Hist. Nat.* xxix. 8), and the contents of it, so far as conveyed in the *Historia Naturalis*, are known to us. Many of the prescriptions were futile, many were filthy, though in later generations they became filthier still, and still more futile; some however were efficacious enough. Narcosis, local and general, was practised, after a fashion. As we find the same or similar recipes in Dioscorides, Scribonius, and other such collections, we infer that Greek and Roman drew from the common sources of an ancient medical lore (see chap. Pharmacy, p. 347).

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[1] At the time of the first publication of these Lectures I had to thank Sir John Sandys for allowing me to see some advance sheets of the then forthcoming *Companion to Latin Studies*, of which he was the editor.

[2] See the Paston and Verney Letters.

The best known of Cato's medical means are the homely and ancient prescriptions of cabbage, and of wine in various forms, for almost all internal complaints; and his magic sentences, gibberish[1] that was uttered over both surgical and medical cases to expedite the cure. Now, although I have not met with the suggestion, it must have occurred to many medical readers that Cato's cabbage, in days when fresh meat was not to be had in winter, or certainly not by the lower orders and the slaves, probably acted very effectively as an antiscorbutic, and that by this virtue its repute as a medicine was made and sustained. The cabbage—*Olus* under its more general name, more specifically *Brassica*[2]—was relied upon as a remedy long before Cato's time; by the Etruscans, for instance, and by the Greeks—at any rate by the Sicilian Greeks of the tradition of Pythagoras; by Epicharmus also, a pupil of Empedocles, who wrote a treatise in the Doric dialect in which cabbage was thus recommended; and indeed by physicians of no less distinction than Diocles, Chrysippus the master of Erasistratus, and, as Galen says of milk and cabbage, by Erasistratus himself. I remember a quotation by Dr. Jessopp from a letter of St. Basil to the Governor of Cappadocia in which the Saint alludes to the cure of the Governor's illness by a diet of (pickled) cabbage. Varro says it was sovran for gout—the ἄβατος πόνος—and for this disease is no unintelligible remedy. Even the urine of a cabbage-eater became possessed of incredible virtues (*De R. etc.* 157). One commentator drily observes that it seems to have failed sometimes in reducing dislocations and in healing fractures.[1] If then Cato erred it was in good company. The variety in use as a medicine in early times was probably the colewort or sea cabbage, which has a slenderer leaf and a more bitter taste.

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[1] From our point of view, gibberish; yet even gibberish may have its peculiar interest. It is probable that not Cato's incantations only, but those also of other times and peoples, are the degraded remains of some ancient tongue. Cato's "Daries, dardaries, etc., . . ." may be remnants of Etruscan? See C. Singer, art. on a Greek charm, *Ann. Med. Hist.* i. 3, New York, 1918, where the author shows that the "Stomen Calcos Stomen Meta Fofu"—a charm for nose bleeding, is a corruption of *στῶμεν καλῶς, στῶμεν μετὰ φόβου* from the liturgy of John Chrysostom. I find in Torr's *Wrayland* (1918) a letter, dated 1844, in which the local wise man was said to have "great skill in bandaging cuts and wounds, and always said some words while he was doing this. . . ." But as he always had the wounds well washed with water and brandy this (rather than the charm) was probably the cause of his success.

[2] *Vide* I. G. Schneider, *Script. rei med. Brassica*=κράμβη, "crambe repetita"; in the late Greek lexicon of Sophokles, κράμβιν -κραμβίον, cabbage. Also Barnard Cook, *Class. Rev.*, 1906, discussion of impregnation of Hera by eating a lettuce.

It may be asked why we should occupy ourselves with Cato who, whatever his merits as a patriot, was, from the point of view of scientific or artistic culture, a gruff, obstinate, narrow-minded rustic, whose violent denunciations of Greek physic were but illiterate prejudice. Well, in this respect I think historians have done Cato some injustice. In no small part we, as physicians, have derived our impressions of Cato from the babbling of Pliny, who had the vanity and garrulity of Boswell without his reverential sincerity. Listen for instance to this passage from Pliny (tr. Philemon Holland): "And learne this of mee, as from the mouth of a true prophet, That whensoever this greekish nation shall bring into Rome their Philosophie, they will corrupt and marre all: but let them send once their Physitians hither, you shall see a greater wrecke and confusion thereby. For I assure thee they have complotted and sworne one to another for to murder all Barbarians, as it pleaseth them usually to name us, by means of their Physicke." But in Plutarch we have a truer appreciation of Cato. It was said he took to learning Greek "in his old age"; "belike fearing," as Sir Philip Sidney put it, "that Pluto understood not Latin"; or, as Professor

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[1] C. L. Taylor, *British Medical Journal*, Nov. 27, 1909.

Mackail suggests, because of his admiration for the younger Scipio. But Cato was no such ignoramus nor belated student; on the contrary for his time he was a learned man. His stoicism, stern and inhuman as it was no doubt when compared with the gentler autumnal wisdom of Panaetius, he owed nevertheless directly to Greece. Ilberg says (*Celsus*, 1907) "We must affirm frankly and readily that in his prose Greek influence is plainly recognisable." And, before Celsus and Varro, he was, if not an encyclopedist or "summist," yet a many-sided author whose chapters, not only on military matters and agriculture but also on law and history, were extant and respected even in Cicero's generation. After his African campaign, and some nine years before his consulship, he discovered Ennius in Sardinia, brought him to Rome, and learned greek of him at an age nearer thirty than eighty years. So that his Greek studies, were they more or less, extended over some half-century of his life. Of Varro, an author of like temper, period, and pursuits (p. 67), Mr. Warde Fowler says that "he consulted Greek books by the score" (pp. 69 and 132, Libraries). So far then from regarding Cato as a narrow and arrogant boor, may we not come nearer to the truth if we regard him, with Ennius, as one of the founders of Roman prose, and put him in some incidental comparison with Petrarch, whose diatribes against physicians were no less unmeasured and indiscriminate? Can we be surprised, on looking back to their several epochs, that the harsh puritan and the petulant humanist, the one and the other alike without scientific insight, denounced the parade, the greediness, the luxury, and the glosses of medical adventurers as they saw them? If Petrarch could not understand or foresee the growth of the scientific thought of his own age, shall we blame Cato in that he did not foresee Asclepiades, Soranus, or Galen, nor perceive that in 150 years Rome would be dependent on Greeks not for her medicine only, but also for her religion, manners, science, and philosophy; and indeed for much of her exquisite if derivative literature? In the *Pro Archia* (51) Cicero says on Greek culture in Rome: "Erat Italia tum plena Graecarum artium ac disciplinarum, studiaque haec et in Latio vehementius tum colebantur quam nunc iisdem in oppidis," etc. If Sir William Ramsay, quoting Wendland, can go so far as to say that indeed in Law also much was taken by Rome from Hellenic practice, and indeed that Roman Law may be regarded as a palimpsest over Greek, if so, far more must this be predicable of Roman Medicine. Of mathematics Rome had none; even her arithmetic was rudimentary. Astronomy amounted to no more than summary and popular versions of Aratus, the elegant poetaster of this science. The admirable reform of the Calendar by Caesar was effected under Greek instruction. Astrologers—so-called "Chaldaeans" (p. 55)—were the interpreters of the heavens, and bore the name of "Mathematici." In geometry, it is true, the Roman was more proficient; this science was needed for immediate practical ends. A great survey of the Empire was made by Augustus, and we read of important schools of "agrimensores." It is remarkable however that the military Roman was not a better geographer. Geography surely was in his business, yet from the maps of the Greek geographers the Roman fell even to the grotesque. Rome produced no such geographers and explorers as did the Phoenicians and Greeks.[1] "Belike" Cato, had he foreseen it, might have thought many Danaan gifts dearly bought at the cost of patriotism, of honour, and of righteousness. From Cato's point of view, was it not possible that the doctrines and rhetoric of Carneades (*c.* 156 B.C.) were for Rome socially disintegrating? Besides, in all military periods of society—except perhaps that of Athens—the craftsman, whether of fine or practical art, has been regarded by the warrior with contempt; even *schola*—leisure itself—in such times is meek. The truth is that for something like a hundred years before our era, as after it, Rome was opening her eyes to her defects in the arts of peace, in science, letters, and philosophy, and was almost pathetically anxious to repair them. Yet it was not till the reign of Claudius that the Greek language became fashionable in Rome.

It is improbable that Cato, versed as he was in annals and customs, would have accepted the absurd assertion of Pliny that for 600 years Rome had done without physicians, a new-fangled calling, and moreover a canker in the State. Rome, in all its wars and plagues, must have had more than a domestic medicine, some accredited practitioners, even if of a Homeric order. For example, even in the reign of Numa the Caesarean operations both for removal of a living child from the dead mother, and conversely, were imposed by law.[1] A liability for this service in case of urgency was imposed upon all citizens, it is true; [2] but these and other operations, such as the semi-sacred operation of trepanning, those for fractures and dislocations, for fistula, stone, etc., which we know were regularly and successfully undertaken, were no doubt as a rule committed to persons of professed dexterity. We know that there were many Greek physicians in Rome in Sulla's time; and certainly in the first century before Christ the "medicus" was plainly distinguished from the crowd of barbers, quack salvers, and wizards; for in the *Digest*, L. 13. 1, we read, "Medicorum quoque eadem causa est quae professorum nisi quod iustior," and the law goes on to include orderly specialists, as for the eyes, ears, and teeth, for fistula, etc. But "Non tamen si incantavit, si imprecatus est," devices which are not of the kind of medicine. To do more than indicate probabilities concerning ancient times of which we have few historical data is otiose; and it is only too certain that in and after Cato's generation many, perhaps most, of the medical adventurers who flocked to Rome were a gang of impostors who stank in the nostrils of high-minded men. Notwithstanding, secluded as early Rome was, it seems impossible that the learned and honourable traditions of the medical schools of Magna Graecia, of Alexandria, of Cnidus, and the rest can have passed over and around Rome, even into distant provinces of the West, such, for example, as Marseilles, Toulouse, Bordeaux, etc., and yet left the Mother of Nations—not even then a very simple society—as if they had never been. On the other hand we may presume that before the influence of Alexandria made itself felt in Rome, before the day of Celsus let us say, few of the higher rank of physicians would have left Greek lands, where as we know from more than a thousand inscriptions[3] they were held in honour and affluence, to dwell in a comparatively barbarous state. Roman youths however had begun to frequent the lecture-halls of Athens, and Greeks were engaged as teachers in the houses of wealthy families in Rome, as English teachers were in Russia. By the time of Claudius the Greek language had become fashionable in Rome, and prevailed down to Trajan and the Antonines; and the cultivated Roman had learned to repudiate Etruscan divination, and to resent the westward tides of Orientalism. After the conquests of Alexander the Hellenising of the East quickened, and multiplied commerce between East and West enormously. Troops of travellers, for adventure, for religious, literary, and sophistic missions, and for gain, sped to and fro; and the vogue of the Greek tongue made the Roman Empire bilingual. Even in Rome itself philosophers lectured in greek, and in greek in Galen's day a Roman Emperor wrote his Meditations.

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[1] See, *e.g.*, Bunbury's *Ancient Geography*.

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[1] Compare old legends of Zeus and Athene, of Bacchus (in Virgil and Ovid), and even of Aesculapius; as well as such celebrated sublunary cases as those of Fabius and Scipio Africanus. The very word *medicus* itself is of early Italian derivation.

[2] In the *Lex Regia*, "si mater praegnans mortua sit, fructus quam primum caute extrahatur."

[3] The oldest and one of the most interesting of these is a portrait tablet in Athens to Aineios (*c.* 584 B.C.), alleged great-uncle of Hippocrates.

Pliny himself, though talking of times long before his own, at any rate knew enough of Chrysippus (p. 138) to abuse him; and gives away his assertion about the golden age of Rome when doctorless, when he says: "Non rem (medicinam) antiqui [our ancestors] damnabant, sed artem [the craftsmen]." Again, how can we say there were, and had been, no physicians in Rome before Archagathus, when in the time of Plautus, the contemporary of Cato, we note such remarks as: "Ibo ad medicum atque ibi me toxico morti dabo"; though we can apprehend Cato's angry repudiations of them. Plautus speaks also of the Roman coin *numus* (=about 1s.) as being not enough for a doctor's fee ("plus iam medico mercede est opus"). Again, Amphitryon exclaims: "I have looked for him in the market-place, in the spice shops . . . in medicinis et tonstrinis."[1] There is in Plautus a good deal more of medicine, with a colour so local that it clearly was no mere hearsay medicine from Greece. Again let us turn, for instance, to the fussy doctor in the *Menaechmi*—written 200 years before Christ—making his visits and boasting of his grand patients. He appears moreover to have had then a Home in which he received sick persons for special treatment[2]—"Ad me face uti deferatur . . . Scin' quid facias optumum?" (that is, for a course of hellebore for twenty days). Lucilius again uses many medical words and phrases—not a few such as cataplasm, etc., taken from the Greek; as if Hippocrates had been filtering in between the generations of Ennius and his own. We note from Plautus also that in those days of dirt skin diseases were evidently rife—"Serpere uti gangraena mala atque herpetica possit."[1]

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[1] Plautus speaks also of interpreters of dreams and omens, and of a charmer against disease—"praecantatrix." That the midwife should be "manibus puris, capite operto" applies, I fear, rather to religious rites than to antisepsis. The midwife of the clandestine confinement in the *Andria* of Terence was a drunken slut. It is scarcely necessary to direct the literary reader to Ménière's delightful books on Medicine in the Latin Poets, and in Cicero.

[2] See Essay in this volume on Hospitals and Public Medicine (p. 443).

Varro[2] (Marcus Terentius) was a full century younger than Cato, he belongs indeed to Cicero's generation; yet he remained an old Italian, a Catonic sort of person; he also was an Encyclopedist or summist, perhaps the first to write and collect under a general title a comprehensive series of articles on various technical subjects. Celsus, and may we not add Virgil whose *Georgics* were written about the same time in Rome, carried this kind of compendium to its culmination. In Varro's nine *Libri disciplinarum* Medicine was the eighth. In the time of Cicero, who was well versed in medicine, and even in that of Aulus Gellius (*Noctes Att.* xviii. 10), a knowledge of the broader truths of medicine, and especially of bodily hygiene, was considered part of the education of a man *liber liberaliterque institutus*; smatterings that, in the contemptuous phrase of Galen, were then degenerating into "philiatry." In the volume of his output Varro almost rivalled Galen; but all is lost except his *De re rustica* and a few fragments. He seems however to have given to Rome less of medicine than of literature, antiquities, and "natural philosophy," especially mathematics; while to popularise "the higher philosophy" and rhetoric was the task of Cicero. Nevertheless Varro says much on the salubrity of sites, and Haeser drew attention to the following remarkable passage:—When the fleet and army of Pompey were at Corfu a pestilence broke out, and the houses were full of sick persons and corpses; Varro however, "immisso fenestris novis aquilone, et obstructis pestilentibus, ianuaque permutata, caeteraque eius generis diligentia, suos comites ac familiam incolumes reduxit."[3]

It is remarkable that Varro, like Celsus, seems to have been wholly free from the alloy of superstition in medicine; and this in spite of the old Italian (Sabine, etc.) folk-medicine. He mocked at Temple cures;[1] and Ilberg points out the irony of his allusions to the magic formulas. Again, Varro had much of the quality of judgement and sagacity which still more distinguished Celsus; his remarkable prophecy of a microbic pathology is no doubt well known to you:—"animalia quaedam quae non possunt oculi consequi . . . per aëra intus in corpus per os et nares perveniunt et efficiunt difficiles morbos."[2] To such microbes indeed he attributed malaria (*De re rust.* i. 12. 2). Moreover it is in his pages that we find the first injunction of isolation of persons attacked by infectious diseases. In the course of time such regulations were more frequent and more strongly enforced.

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[1] Cancer, of course, was well known from early times; Ovid's "Utque malum late solet immedicabile cancer Serpere" is an apt, though a late allusion to it.

[2] Varro's three books on Farming have been well translated and annotated by Storr-Best, London, 1912. Reviewed by Warde Fowler, *Class. Rev.*, May 1913.

[3] Columella and Varro. See Morgagni, *Opusc. Misc. Epp. in rei rusticae scriptores*,

We must not suppose indeed that the stubborn and imperious Roman was wholly alien from speculations on the nature of things. Besides Celsus and Varro, we think at once to the contrary of Seneca, of Pliny himself, and indeed of Virgil. Even at the end of the Republic and in the early Empire the bent to liberal studies was becoming free and general; it was thrust back by the military domination of and after Commodus, a preoccupation due to the peril of barbarian irruptions. The Stoics, it is true, cared but little for natural science, and the science of Epicurus was but a moony light; yet the Porch, to please its public, was obliged to put a large patch of physical science upon its philosophy; chiefly from Heraclitus.

Pious and magnanimous as *Stoicism* was in the field of conduct, creating or nourishing that elevation of mind which distinguished the nobler Roman of the Empire, as likewise the great Englishmen of the eighteenth and early nineteenth centuries, of an ethical temper moreover which chimed with Christianity and to some extent even penetrated into its substance, yet in Rome, as in England, its natural science was of no account; the spirit of it was indeed rather alien than akin to science. The mind of the Porch, which called itself practical, was reluctant to all "speculation," natural science included. It opposed astronomical and other physical sciences, and was satisfied with a thin and crude blend of Heraclitean flux, of the Empedoclean four elements, of the Aristotelean firmament, and of the Hippocratean humours.

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[1] Here I may repeat the quotation:—"Hospes, quid miras nummo curare Serapim?" See Ribbeck, *Gesch. d. röm. Dichtung*, i. 251.

[2] "Certain living creatures which the eye cannot follow . . . pass by the air through the mouth and nose into the body, and set up grievous diseases."

In respect of the elements: the Stoics took the qualities—cold, warm, moist, and dry—as primary: against Aristotle and his predecessors for whom the fundamental elements—earth, fire, water, and air—were primary. So far as it meddled directly with science, as with astronomy, stoicism was ineffectual. For the Stoic then, as for the Epicurean, science was provided rather as a buttress than as an integral part of his structure; and in each both science and philosophy were subordinated to ethics. Such was the Attic as contrasted with the Ionian tradition, as we see perpetuated in the writings of Cicero. The heavens were too remote, and the mechanism of the human body too subtle and complicated, to be fruitful subjects of contemplation. And above all for social life these and such studies were unnecessary—in respect of the plague for instance! Now while the ruling classes of Rome were turning away from Epicurean to Stoic philosophy, its people was hungering for a new religion; for no philosophy had the cementing effect of a religion upon social cohesion.

We are apt to underrate the knowledge of greek in Rome from pre-Augustan times onwards, because we look back through the darkness of the evil done to learning by the barbarous Domitian, who drove the scholars away to Athens. But Vespasian had founded chairs of greek in Rome, when Quintilian became "the first professor at about £1000 a year;" and he gave or ratified immunities to teachers of rhetoric, grammar, medicine, and philosophy. Nerva and Trajan followed in his steps, as of course did the Antonines; but none of these lived so entirely in the Greek spirit and philosophy as Hadrian did; or would have done had he not been perpetually dragged into wars. During all this period greek was fashionable in the more cultivated circles of Roman society.

And may we not tarry for a moment to glance at *the records*, the fragile bridges which have carried ancient wisdom and knowledge down to modern times: bridges largely constructed and kept in repair by slaves? From Alexandria to Louvain books have suffered much destruction at the hands of savages. Of Greek libraries before the Roman Republic little is known; but in the later Republic Greek books, especially of oratory, were used in the schools (see p. 206). Pisistratus is said to have founded a library; and we know something of the Library of

Aristotle (p. 132) which seems to have served as the foundation of the first royal Alexandrian, which was destroyed but was succeeded by one far finer, that unhappily suffered a like fate. Sir Frederick Kenyon says however that even after the Caesarean conflagration Greek literature was represented in Alexandria in substantial completeness (*J.H.S.* xxxi., 1919). In Xenophon (*Mem.* iv. 2. 10) Socrates says to Euthydemus πολλὰ γὰρ καὶ ἰατρῶν ἐστι συγγράμματα, which last word L. & S. translate as physicians' prescriptions. This cannot be right; Prof. Jackson tells me *books* is the nearest rendering. The great Pergamine Library rivalled that of Alexandria, whither indeed it was afterwards conveyed. In Rome Varro is said to have founded the first public library, between 39 and 27 B.C., in the Atrium Libertatis (see p. 206).[1] Two libraries, associated with the name of Augustus, containing books both greek and latin, were destroyed by fire—the Octavian in 80 A.D. (Dion Cassius). Libraries established in the midst of colonnades, temples, and forums, became the resorts of literary societies; one on the Palatine Hill was open to the public, and some at least of the books could be taken out. A library containing reading rooms was discovered in Napoleon's time in the forum of Trajan. Books, produced by slave labour, were probably fairly abundant and so relatively cheap. The numbers written were enormous; Menecrates is said to have written 150 books ("papers" as we should say?), Hermogenes 77 — all vanished. The library excavated in Herculaneum seems to have contained some 1800 rolls which were indexed and arranged in closed bays in the walls, as we see to-day in the Vatican Library. Wealthy collectors again, from the second century B.C. onwards, to fill their *armaria*, carried quantities of books, as spoils of war and plunder, to Rome. Seneca scoffs at such persons as admirers but not readers of their treasures. Of Cicero's great collection, and his librarian, we know more: and that he made a better use of it. Galen's rich library was burned in a fire in the Via Sacra.

Indeed before the invention of printing one might almost say that a large collection of books, by its attraction for readers, almost made a university. By his collection of MSS. Frederick II.

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[1] See Professor Boyd's *Libraries in Rome*, Chicago, 1915, some of whose references also I have followed up.

did much to establish the University of Naples and to outbid Salerno.

While such then was the general literary and medical equipment of a Roman gentleman, and while also even under the Republic we read of *medici* rich enough to own *slaves*, yet it is true that the technical practice was largely confided to domestic slaves. But we are not to suppose the slave of those times to have been what the haughty Roman took him for; nor to judge him on our prepossessions derived from negro slavery, and thus to regard Roman medicine as a practice only of serfs, or of venal freedmen. The slave trade, amid the raiding and seafaring races, was enormous; but the Greek, and not the Athenian Greek only, must, even as a slave in Rome, have been upheld by a consciousness of high blood and great traditions. In ancient times the dukes of all Greek lands treated their slaves with courtesy, and even with intimacy. Perhaps in Sparta only were slaves held in subjugation and contempt. Plato in his Republic gave no place to slaves. Aristotle, it is true, argued for slavery, but showed thereby that the question was open to argument. For Euripides the institution was an uneasy problem.[1] The Roman medical slave was usually a Greek; and his price, by law fixed at not less than 60 minae, was a high one. Slavery was a convention enforced by the hardness of the times; the captive of whatever nation was not usually of an inferior race, but in brains as well as in dexterity often superior to his owner. His bondage was an accident, and on manumission his personal qualities often commanded such professional success and independence as to dissipate the sense of gratitude and attachment, and thus to give some check to a manumission whereby valuable services might be lost to the patron. Albeit, whatsoever the personal virtues of the slave, the debasing pressure and conventions of that status must have thrown a shadow upon his character; so that the Greek, by nature slippery and inconstant, as a freedman—and even between the *libertus* and the Roman there was still a chasm—too often betrayed himself as a stealthy and venomous rascal.

Of medical colleges and public medical offices I shall treat in another essay (p. 443); but, speaking generally, it is true that in Rome itself there was no kind of *professional* test or *standard* to discriminate sharply between such *medici* as the gentle and accomplished freedman Antonius Musa or the botanist Lenaeus, and villains like Vettius, the paramour of Messalina. As manners softened, and intelligence and skill compelled recognition, the position of slaves and freedmen improved more and more, especially under the enfranchisements of Julius and Augustus; but their calling could not well progress nor gain public recognition as *ars prudentiae maioris*. There was no serious attempt to establish tests and licence to practise until this was done at Salerno.[1] Notwithstanding, even under the Empire, Roman medicine remained almost wholly Greek: for the few physicians, such as Scribonius Largus, who bore latinised names, were nearly all of them Greeks. Sextius Niger and Julius Bassus, in Caesar's time, were probably Romans, though, as the medical fashion was, they wrote in greek.[2] An interesting parallel to this is, or was, to be seen in Japan. To the Germans the Japanese owed much of their instruction in modern medicine: and when, some years ago, I visited the hospital of Tokio the notes of the cases, autopsies, etc. were all recorded in german: the lectures also were, I believe, given in german. From the time of Claudius, as I have said, greek became fashionable in Rome.

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[1] See G. Murray, *Rise of Greek Epic*, p. 16.

How are we then to explain that enmity of Cato: and the malice of Pliny who, while he endeavoured to ignore the physicians, could not refrain from signifying by his indiscriminate if not wholly unjustifiable abuse that they existed, and among the *antiqui* had existed, only too abundantly? Why, the fault of these physicians was not so much that they were crafty and rapacious as that their craft and rapacity were not of the Roman sort. As the physicians in Rome were practically all Greeks, so their ideas were Greek, so Greek that few Romans of that time could enter into them; furthermore, these Greek notions appeared not only profane in medicine, but in their more general tendency socially subversive. The scent of a ruling class, secular or ecclesiastical, after inquisitive or esoteric opinions is amazingly keen, and its resentment ruthless; and how haughty, ruthless, and unreceptive on the whole, was the temper of the conquering races in Rome, how austere their religion and rites, how rooted their superstitions and folk-medicine, how obstinately impermeable their qualities and customs to new ideas, and how incapable of elastic adaptations, we know already. Order not progress, was, as still it is, the mission of Rome. We shall not wonder then that these conservative opinions and instincts should have incited, especially in Republican Rome, an alarm against foreign ideas. For the old Roman of the type of Cato, austere and imperious as he was, was also, consciously or subconsciously, apprehensive of the instability of his State. Built not only upon slavery but also upon the quicksand of a restless, excitable plebs, mostly of alien blood, its security could be maintained only by the rigidity of the old iron will, consecrated tradition, military framework, and hardy strenuous habits. Above all things, especially in a military state, social cohesion was essential; but germs, even of truth, are ferments or "catalysts," and, whatever the issue for reintegration, imply for the while disintegrative phases. The dominant class then was clinging fiercely to creeds and rites whose validity they dare not question, and to intellectual conventions which, already sapped by Hellenic curiosity, were ultimately by Christianity to be overthrown. This issue the old Roman foreboded, dimly but uneasily. And is it too fanciful to surmise that no less dimly, yet by some community of racial instincts, the bent of the subject or plebeian Roman was more apt to assimilate the notions of his distant kinsfolk of the Aegean, and to be stirred by the fickle passions, the irresponsible wit and faction, of that clannish primeval race, then, as before and since, though submissive to despotism intolerant of rank and order? Such may have been Cato's presages; such at any rate was the upshot. For with spoils came luxury; with the deletion of Carthage ease and security at home; with intellectual curiosity the sapping of creeds; with decay of patriotism dependence on provincial and foreign mercenaries; with the Early Empire the infiltration of oriental ideas. It is scarcely correct, I think, to say that Rome was unstable for lack of a middle class; the equestrians took some such place: the instability lay in the rift between the ruling classes and the plebs, an unassimilated and naturally turbulent mass; a large member of the nation but not united or organised in it.

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[1] Ord. Roger 1140 A.D. See also in this work Public Med. p. 459.

[2] As in the sixteenth century to write a medical treatise in the vernacular was a rare piece of audacity, Grevin had to justify his french translation of Vesalius (*Epit. Wechel*, 1569), by declaring that it was "for the surgeons, a more ignorant body."

CHAPTER IV

ORIGINS OF GREEK PHYSIOLOGY—IONIAN AND ITALO-SICILIAN

> For there I picked up upon the heather,
> And there I put inside my breast,
> A moulted feather—an eagle's feather.

I. The Ionian

Such then was the community into which Greek Medicine was transplanted; what and whence was the plant? In looking back, as in history we must, to the sources, we are obliged to tarry a while to consider the sages of early Greece; many of them were physicians, and all perhaps, as we know of Democritus and Anaxagoras, interested in medicine. On the other hand, medicine has always taken much of its colour, its methods, and its ends, from the philosophy of the time. The Socratic method was a mode of diagnosis, in the field of philosophy.

Long before its transplantation into Rome, Medicine had made a large and independent place for itself in Greece and Alexandria; it had assumed many forms, allied itself very variously with other branches of science and philosophy, spun systems of doctrine, and split itself into intricacies of heresy with an industry and ingenuity, nay with a zeal and acerbity, almost ecclesiastical. It is for this reason, in order to reach a point of view whence to trace, survey, and comprehend the various currents of medicine as they gathered and divided in and about Rome, that we have to turn backwards in time to gain an outlook over the Hellenic medicine whence they mainly derived, and over the philosophy upon which its physiology was built.

In all periods of high national vitality, whether in Ionia or Athens, Florence or Great Britain; whether in the times of Socrates, Paul of Tarsus, Dante, Harvey, or Wordsworth, in periods when the common life of men is exalted, the captains of mankind have in them so much of the prophet and poet that they are inspired by visions beyond the visible, and press ardently forward to realise them. You remember also that the outburst of Ionian genius was not in science only but also in letters (Alcaeus, Sappho, Herodotus), and in architecture and sculpture; Ionian artists, *e.g.* the vase painters, were in demand far beyond their own country. Ionia was celebrated also for working in metals (Herod. i. 25). By the distant but growing light, beyond the things realised, far beyond things analysed and classified, the eyes of the sages were uplifted, their hearts warmed, and their steps so hastened that Thracian handmaidens and others might laugh as they stumbled over the homelier facts at their feet. Their disciples half seeing the light, and the blinder peoples flushed by strange stirrings of the blood, straggle after them, pathless, whither they know not; while, as engineers, the regiments of science march in order through the random ways of the impassioned multitude, making good the ground, plotting and paving, measuring, mapping and consolidating. Yet it is by the idealists, by the prophets in the van, that these ardours are kindled in the hearts of men; theirs are the eyes which are fixed upon the morning star, theirs the feet that are beautiful upon the mountains, theirs the voices that proclaim the new inheritance. Not the gods, said Xenophanes, gave the origins of culture but man himself "always through the ages searching for the better." It is to reach this point of larger view that here I permit myself a somewhat long digression, both in time and space, to recall the story of the Ionian peoples of Asia Minor and the Islands, from the beginning of the sixth century.

One of the most poignant aspects of human life is the perennial warfare, the rage, between the idealist and the man of affairs; indeed it is of this war that tragedy and comedy are begotten. It is a materialist prophet of to-day who bewails "the untamable wildness of the good." This is the story of Paul before Festus; of Francis before Elias and the Pope; of the "Lady Helen of Troy, pacing to and fro with a nosegay in her golden shawl"; of Mrs. Elizabeth Fry; of Garibaldi before Cavour; of Rome as "the eternal holy City" before the chessboard of the Papacy: or again, of Quixote before Sancho, or the modern curate preaching Tolstoy before his country rector. The dilemma is *ambulando* insoluble; yet only when men are striving for high ideals is there any history worth recording. Do not let us flatter ourselves when we have put their ideals on one side that we are above them.

Of this kind is the story of the great Ionian idealists, the philosophic dreamers older than Hippocrates and Aristotle; the story of the Greek speculative reason, touched with an oriental mysticism, before imperious Rome. A distinguished modern author of the extremer Western variety has lately reiterated with uncompromising emphasis that in the sphere of ideas we owe all we are worth to the Greeks; the claim however cannot be admitted without profound qualification. The Greek was the prophet of the "*Via Media*"; but to the idealist the *via media* has always been detestable, as detestable to John Knox as to John Henry Newman. The achievement of the Greek was the loftiness of the plane in the fine arts—of which I have not to speak,[1] as well as in the sciences, on which the seer of both blended and integrated the ideal with the actual; the high mean of his *via media* between the imperative categories of the idealist and of the materialist. By an exquisite insight and tact he renounced not only much of the uses of the comfortable and pragmatic kind, but, as we perceive in Plato (*Republic*, etc.) as well as in Aristotle, he definitely relinquished also the vision of some of the elements pertaining to the ideal society. The Greek saw "the untamable wildness of the good," saw it even with sympathy; in the Ionian imagination, beside its Greek freedom and lucidity, there was a waft of oriental airs, a leaven of romance, but the Greek saw also how much of it would not come into his picture.

Now toward these horizons of blended or contrary material and spiritual discernment Rome had no lofty outlook. We say, not without some self-congratulation, that Rome was too "practical" for such issues; the average Roman was above all things the practical man. Well, were he as audaciously complacent as Dr. Archimedes Silverpump of the Lycurgus House Academy, he had no doubt his enormous place in the world's history. Still it is true that his work, fundamentally necessary as it was, the necessary framework on which modern Europe should be built, was after all but a substructure, and the Roman a labourer to be dismissed when his task was done. While the Roman pavior was wielding his beetle, while with plumb and square he was shaping and laying the great blocks for the edifice upon which we are designing and building the superstructure, even then ideas could not sleep. We see the leaven of alien minds in Rome fermenting, expanding, and penetrating to the joints and marrow of her estate; and, as if in mockery, displaying upon her sullen atmosphere phantoms of what after her was to be: even then Rome was not permitted to forget that man cannot live by bread alone; not even if the loaf be guarded by the policeman. As Professor Gilbert Murray says, "that dangerous and unprincipled element the sense of beauty will break in." It is this untamableness of ideas, this unconquerable mind of man, which makes the fascination of our story of the Greeks in Rome; as it does of the history of the Jews; or of the ideas of to-morrow, in barbarian and in modern Europe. Nay, if under other guises, the conflict of Mammon, of Barbarian, of Pagan, of Jew, and of Christian was never keener or more searching than it is to-day.[1]

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[1] I may allude however to the well-known vases found in Etruria but painted by Ionian artists.

Now, as in our own land also, we congratulate ourselves—too often perhaps—on being above all things "practical" men; and, as in respect of the function of Rome, this term is often used as sufficient for all explanation, may we tarry for a moment to ask the meaning of it? For instance, is Euston terminus more "practical" than the Pantheon? or the Pantheon more "practical" than Santa Sophia or the Parthenon? And if so, why and how so? To answer this question must we not consider which of these achievements will have the most abiding use for mankind? Furthermore, we might ask if the ideas of the order of Euston, or of an Atlantic steamship, exist for the sake of the ideas of the Parthenon, of Canterbury, or of William Wordsworth? Or conversely? We cannot here pursue such a train of thought very far, but we perceive that by "practical" in the Roman sense we mean the immediate needs, the short run as against the long run, the things and devices of to-day as contrasted with things to come; an adept calculation and encountering of transient contingencies as contrasted with larger, future, and more consummate ends. In ordinary English use any idea is "practical" when it has prompt money in it; when it has not it is "theory." While we admit then that Rome was laying the material bases of social order and culture, we perceive that with the issue of this material function her civic life began to decay; for to ends she had contributed little. That when hope, faith and vision fade all is gone, is one of the chief monuments of ancient Rome.

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[1] These words were written five years before the war; I leave them without comment.

We are not surprised then to hear that the Greek too, not Aristotle only but Plato likewise, regarded himself, indeed, as above all men "practical"; that in all the schools of ramifying philosophy the conscious, deliberate, and prophetic purpose of each was the art of life—the *βίος τέλειος*. Shall we not then consider why we defer to the Roman as conclusively the "practical" person; have we not described him rather as the artisan of a material office, as the pioneer before the architect?

So let us return to the philosophers of the Ionian land; no work, ardent as it was, inspired as it was, could have seemed more visionary and less "practical" than theirs. In the later Attic reaction, in the restraint of a more measured harmony, their exorbitant speculations seemed overwrought and in the void; Socrates would not concern himself with their physics, and to this day they are too often regarded as vacuous bombinations. Now the Athenians had no heart for natural science; indeed they regarded all analysis and curious dialectic, even in philosophy, as solvent of that authoritative tradition and "moral" which as soldiers, statesmen, and orators they cherished. Hence this jealous intolerance of Anaxagoras, of Socrates, and possibly even of Pheidias. Yet, in summary, to the prophetic genius of Ionia, the "sapienza poetica" of Vico's happy phrase, we owe at least four cardinal ideas, ideas which lifted the earth into the universe, revealed the universal spirit, the creative process, and the universal order: the four master ideas which, within my present limits, I must indicate nominally as the Cosmic idea, the Dynamic idea of a continuum of streaming and indestructible energy, the Atomic hypothesis, and the compound idea of Natural Law and of Evolution. And to these I might almost venture to add a notion of gravitation. As we glance at this childhood of science, idly noting perhaps little more than its obvious puerilities, we are apt to forget the ironical question, What is the use of a baby? But some further reflection will make manifest to us, behind this inexperience, an insight and an apprehension of essential qualities which 2000 years have enormously developed, but hardly regenerated in principle. It is startling to feel how near us these great thinkers are, how much nearer than Abélard and Aquinas, when they unfurl the canopy of heaven into the aether of infinity, when they prophesy of celestial and terrestrial physics, of natural law, of evolution from rudiments, of condensation and attenuation, of molecular energy, of formative combustion, and even of mind-stuff.

In discussing Greek scientific history a convenient division between an earlier and a later period may be made at the time of Aristotle ; while longitudinally, if such an expression be permissible, I may separate the course of the more dynamic ideas of the great Ionian physicists—Thales to Democritus—from that of the more static conception of Parmenides and the Eleatics, which, somewhat arbitrarily for brevity sake, I shall treat summarily, as I must forbear to pursue its later transitions through Philo, Paul, Origen, and Basil. But it is of considerable importance to trace the influence of the pre-Aristotelian period upon the Sicilian school, and the effects of the confluence of the Sicilian and Ionian streams.

Now to bring these radiant visions under some measure of realisation (ποίησις), and to vindicate the values of medicine and natural science, independent of philosophy, arose in the fifth and fourth centuries respectively, two great men of other gifts—namely, Hippocrates and Aristotle. The reader of the greater Hippocratic treatises will find, as Gomperz has generously declared, the door opened upon a way which to us has become so familiar that we find it difficult to understand how in its own day Medicine revealed the growth of a method of thought and discovery then wholly new to the world—namely, the scientific method as contrasted with scientific ideas.[1]

Now who was this great Hippocrates, this prodigious man ? Was it by the power of medicine that he was fashioned thus out of the visionaries of the age ? He seems to have been one of those great persons who, like Moses, Thales, Pythagoras, Socrates, Paul, Francis of Assisi, Luther, Lincoln, had he himself never written a line, would have become, by sheer personality, immortal. That he did not stand alone, that he must himself have been the product of a great school and of a great tradition, our historical sense would bear witness. It is no barren fancy to associate the Father of Medicine in our imagination with the Father of History. Both inherited the luminous Ionian mind; and the author of *Airs, Waters, and Places*, cradled on the same enticing seas, had likewise travelled widely and observed shrewdly; both saw common things under the species of a large humanity. Indeed, the Hippocratic scriptures themselves thus testify to some great school and tradition of medicine which, sown and watered in a forgotten and unrecorded past, bore ultimately its golden fruit in the great master himself, and onwards in Aristotle and the scientific schools of Alexandria. Let us mark then where and under what intellectual conditions Hippocrates and his school arose.

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[1] For an interesting and discerning comparison of rational analysis with the imaginative, impersonal insight of myth and poetic tradition, often of deep intrinsic philosophical meaning, see Flint, *Study of Vico*, 1884. There is no writing extant which brings this new temper so impressively before us as the Hippocratic treatise on Ancient Medicine. Herein is set forth the way of experience, of careful observation of facts. And, somewhat sharply controversial as it is against unbridled speculation, and the deductive application of philosophical ideas to the interpretation of natural phenomena, it is yet interesting to note that this treatise is also of Ionian origin.

When in the writings of modern mythologists, such as Frazer, Farnell, and Fowler—a remarkable trinity of F's—we read of the nightmare of evil spirits, of the ghastly ceremonies, and grotesque rites and customs which encompassed and dominated primitive man and societies of men, which in a diminishing gloom and menace long survived, and even now are not extinct, we shall marvel the more at the *ἀδεισιδαιμονία*, the freedom from superstition, of the Ionian colonists and their great teachers; of Thales, Heraclitus, Hippocrates, Leucippus, and Democritus (Abdera was an Ionian colony), and others of that great time and temper of mind. As their political freedom was menaced the finer spirits departed from the Asiatic coasts to Abdera, Elea, Croton, etc. Not even yet, I think, have we fully realised the marvellous freedom of the spirit in which Hippocrates, in reply to those who said that epilepsy was *θεῖον*—a supernatural and divine visitation, uttered these immortal words:—"Indeed in my opinion these maladies, like all other things, are divine, and no one thing is more divine, or more human, than another, for all things are alike divine; yet each one of them has its own natural properties and cannot come into existence without natural causes (*ἔχει φύσιν τὴν ἑωυτοῦ καὶ οὐδὲν ἄνευ φύσιος γίνεται*)." Again in this very interesting and original work (the Περὶ ἱερῆς νούσου—*On the Sacred Disease*) on Epilepsy, a malady that has been attributed to divine or demonic influence, the author rescues it from the magicians, exorcists, purifiers, propitiators, and deliberate charlatans who undertook to evade such supernatural influences. As Littré says, to find his doctrines firmly re-established we have to come down almost to our own day.[1] In the words of Cicero (*De N.D.* iii. 10), phenomena that, as in tertian or quartan fevers, recur regularly, you reduce to reason; but when they are incalculable "tanquam in aram confugite ad Deum." It is a striking fact that to the Greek philosopher the ideas of uniformity ("law") in nature, and of divine governance, were not, as too often in our day, supposed to be in opposition, but congruous and mutually suggestive. To take Cicero again as a reflection of the Greek mind; he says "Vide, quaeso, si omnes motus omniaque quae certis temporibus ordinem suum conservant divina dicimus" (*ibid.* iii. 24).[2] Indeed, more than a millennium before Montesquieu, Buckle, and Taine, Hippocrates declared that "It will be found for the most part" (not altogether be it observed) "that the forms (characters) and customs of men (τὰ εἴδεα τῶν ἀνθρώπων καὶ τοὺς τρόπους) are the result of the natural conditions of the country they inhabit"; a view which, in his treatise on *Airs, Waters, and Places*, he expanded and enriched. When we compare Ionia, let us say with Thessaly the dark home of myth, magic, legend, and fantasy which, before and since those words were spoken, have bewildered the visions and clouded the ideas of mankind, we may stand amazed at the freedom and perspicacity, the gradual and consistent development, the spontaneity in unity almost organic, of the great Ionian philosophers. Whatever we may think of Epidaurus, Ionian Greek medicine was not theurgic; probably not even at Cos. In the medicine of the *Iliad* there is neither theurgy nor mysticism; and but little — a few incantations —in the *Odyssey*. Again in the *Timaeus* (No. 89) even Plato, rejecting all entities supernatural or philosophical, takes the scientific view of the constitution of diseases; he argues that, even if by medicine we try to subdue them regardless of their appointed periods, we may but exaggerate, or even multiply them: on the contrary, he argues we must patiently by diet and regimen wait on nature's own processes. That Hippocrates influenced Plato directly and greatly there is little doubt (pp. 232-233); yet both these great men were in harmony with the wonderful insight of the scientific teachers of their people and epoch. Let me not be understood to mean that the eclipse of these, and such other bright and lucid moments in the history of man, must therefore be altogether a matter for lamentation. Although it is true, strangely true, that societies of men have had their periods of arrest and of retrogression, that societies or groups of societies have not always been making for progress; and again, although it is true indeed that not a few stretches of historical time, and continents of space, appear to have been times and scenes of unmitigated destruction or degradation, yet when on the whole, or in some periods, some human societies have grown and borne fruit, we may ask whether this development has been in spite of a spectral and ritual bondage almost universal in early societies, and conspicuous in ancient Rome, or in part, strange to say, by the help of it? Have the chthonic and demoniac apparitions, tyrannical rites, visionary myths, been always, as they may seem to have been, a curse to human societies; or have they been coercive influences without which primitive men could not have been gathered, hammered, and welded into solid groups, and mischievous only in their perpetuation beyond their due time? The lesson of history suggests that in their time these influences, to all appearances so inhuman or so grotesque, were not disruptive but organising compulsions, which made for the survival of societies. The mischief then lay, and lies still, in their bondage on men who have outgrown them. So on the return of the more primitive impulses of war they reappear. It is notable that the Greek peoples who, far less on the whole than other races, were compelled or oppressed by superstitious creeds and practices, were also, as social groups, less coherent.[1] However, such considerations are somewhat foreign to my subject, which is not to speculate on the political effect of a scientific attitude upon Ionian or other social groups, but to inquire how far the Ionian speculations—for experimental science had hardly begun—were in bent and quality scientific, and in particular how far, and in what way, they entered into or influenced Greco-Roman Medicine.

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[1] See Diogenes Ap. p. 109; also F. Heller, "Hist. of Epilepsy," in *Janus*, 1911; not however a very thorough study of the matter.

[2] Professor J. S. Reid reminds me that this argument of congruity is not confined to the Stoics; that there are many similar contentions elsewhere, as in Plato and in the writings of other ancient schools. Thus it was for very early Greeks that κόσμος became the name for the universe. For the Stoics of course the order of the universe had also an ethical value; see Cic. *De N.D.* ii. 37; *De senect.* p. 77, etc.

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[1] It will be understood that in this appreciation of the Ionians I am speaking wholly from a scientific and conceptic point of view. What the Ionians may have lacked in reverence and sanctity would be a very interesting but another inquiry.

In dealing with an imperfect history of transcendental hypotheses I must ask for some indulgence. It has been well said that "When you try to go deeper and understand what were the driving forces in the construction (of hypotheses), to distinguish the points about which the teachers cared from the supporting (framework), you are on conjectural ground; you run the risk of following subjective fancies. But it seems that in all vital interpretations of human work this risk must be run";[1] and recently many authors, such as Wilamowitz-M.,[2] Benn, Professor Burnet and others, on the foundation of Diels' *Vorsokratiker*, and his *Doxographia Graeca*, have done justice to this fascinating side of history. Wilamowitz says that it was Schleiermacher who, by his essay on Heraclitus in 1807, first threw a modern light upon it. Furthermore, let us remember that for these, and other, ancients symbolism was their way of abstraction, and we have to trace the distillation of the one into the other.

Since my earliest historical studies I have been more and more impressed by this ascendancy in Greek and Greco-Roman Science and Medicine, from first to last, of men of Ionian culture; but this truth, however well known to a few scholars, has not, I think, yet received the closer attention that it merits.[3] Of the cosmological speculations of the early Ionians—Thales, Anaximander, Anaximenes, Heraclitus, Anaxagoras, and the others of that wonderful band, historians are no doubt well aware; but is it generally realised, for instance, that the Italo-Sicilian School of Pythagoras, with which we shall deal presently, was of Ionian origin or inspiration? For Pythagoras was an Ionian of Samos,[4] which, as it happens, was an Achaian Colony. Now we shall see that from Ionia, from this region so extraordinarily fertile in scientific genius, came directly or indirectly, almost all the greater physicians of ancient times.[1] The habits of classical scholarship have concentrated our vision too narrowly upon Athens; now Athens, as I have said naturally indisposed to physical science, which she thought was not for orators, soldiers, statesmen, or moralists, owed what scanty physical conceptions she possessed to Ionian centres, such as Rhodes and Miletus.[2] Socrates, as we know, regarded physical speculations as, if not otiose, yet of secondary importance,[3] although Plato, a really great mathematician and a more scientific thinker, did not agree with him. Yet Plato unfortunately despised the applications of science to the technical arts of man, not perceiving that from these arise some of the most luminous principles of academic science; nature being more ingenious and multiform and unexpected in operation than any laboratory. To Plato indeed, under the influence of Philolaus and Philistion (pp. 232-233), the blending of Sicilian and Ionian ideas was largely due; and to Ionian physics the *Timaeus* owed its curious speculations on the constitution of matter. Descriptive biology could progress, as it did under Aristotle, without mathematics; Aristotle indeed constructed a logic to take its place.

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[1] Bevan, E., *Stoics and Sceptics*. Oxford, 1913.

[2] "Ionische Wanderung," *Stg.-Ber. Berlin. Acad.*, 1906, iv.; and the previous article no "Panionion."

[3] I leave this as written some years ago.

[4] The reader must picture to himself these islands not, as now, barren rocks, the homes of goats, and the resorts of a few curious tourists, but as busy centres of maritime trade. Their present state is the issue of centuries of Turkish rule, of piratical raids, and of reckless waste.

But to return to Medicine: Cos and Cnidus were Ionian; of the two parents of Alexandrian medicine, Praxagoras was of Cos, Chrysippus of Cnidus. Eudoxus—the famous astronomer, first founder of a theory of the spheres on direct observation, and by no means ignorant of medicine, the chief link indeed of science with medicine—and Herodicus were of Cnidus; Aristarchus of Samos. Diocles, of Carystos at the south-east point of Euboea, was born in the Ionian Sea, and afterwards was nurtured on the Ionian tradition of Sicily. Andreas, the Herophilean pharmacist (p. 363), was also of Carystus, and Nicander of Colophon. Herophilus, a pupil of Praxagoras of Cos, was an Ionian of the north; and is not the same to be said of Aristotle? Erasistratus, a master revered, as we shall see, by Greek physicians in Rome, was of Iulis in Ceos, the home of Simonides and Bacchylides; and there Nicias the Milesian physician was his fellow-student.[1] In Roman times, Asclepiades was of Prusa in Bithynia; Themison of Laodicea; Menodotus of Nicomedia; Athenaeus of Pamphylia; Archigenes of Apamea; Dioscorides of Cilicia; Galen, Marinus, and Oribasius were of Pergamon; Alexander (and his distinguished brother the architect of St. Sophia) were of Tralles; Soranus, Rufus, and Menecrates of Ephesus; Aetius was of Amida, a remoter town away on the Tigris, and so forth: leaving many others of note unnamed. Contrast these districts with Epidaurus in which there was no tradition of science; there priests, dreams, visions, wonders, and snakes held the field. If then genuine medicine ever came out of any of these temples it was from the Ionian Cos and Cnidus, not, as is too often supposed, from Thessalian or Epidaurian sanctuaries.

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[1] I must not trespass into literature, but I have suggested that Herodotus (the historian), a native of Halicarnassus, had very much the same scientific kind of sagacity as Hippocrates.

[2] The "Ionian League" was but a political unity in time of peril; and the sentimental filiation to Athens an "entente" against Persia.

[3] See *Apology* 19 and elsewhere.

Now these gifted people or peoples, the founders of science and medicine, settled on the coasts of Asia Minor from Troy to Tarsus, were not by any means a homogeneous race, nor even a people moulded and shepherded under one tradition, or paramount caste. Racially Aryan—as distinguished from the central Anatolian, or Cappadocian people, which was mainly Hittite, and on the other hand from the Achaeans—the Ionians, if primarily, shall we say, "Pelasgian," soon became qualified and varied by the settlement of mixed lots of colonists ("Volkssplitter") and of sundry local tribes—Carian, Lycian, etc.[2] Sir W. Ramsay says that the kindred folk of Greek origin were an adventurous, progressive, and inventive people; as were likewise Carians, Lydians, and Lycians: "The young, lighthearted masters of the waves." But as, under the Dorian invasion, the focus of these settlers, largely perhaps of Minoan sea-folk, had been driven across the Aegean, they carried with them the arts, ideas, and civilities of the West; and on their migrations, travels, and trade absorbed fresh influences from Egyptian and oriental speculation. Notwithstanding, their outlook was, as always it had been, westward; they were endowed with the vivid artistic and intellectual gifts of the smaller and darker race, their world was continually thus enlarged and enriched by sea trade and adventure in Egypt—

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[1] Helm, in an interesting article in *Hermes* (xxix., 1894) on the date of Erasistratus, translates the word συμφοιτήτης thus, not as "disciple." The relation is mentioned by a scholiast on the twenty-eighth Idyll of Theocritus.

[2] Perrot and Chipiez, *Phrygia, Lydia, Caria, and Lycia.*

especially under Psammetichus, the Aegean, and their own hinterland (Herod. i. 29); and their soil was more fertile than that of Greece proper. Moreover the increase of Ionian commerce on the coast of Asia Minor in early times supplanted the trade of the East with Greece. The effort of Sparta to recover this trade seems to have led to her interference in Ionia in the sixth century. Again, by northern immigrations or invasions, such as the Achaian, they were not stiffened only; Mr. Hogarth has pointed out how from the north, about 1000 B.C., the Ionian Aegeans drew fresh inspiration and a robuster vitality from their kinsfolk of like culture, the Balkan and Danubian bronze people, who, if too often confused with the Etruscans, yet did likewise deeply influence Rome herself. Still, ingrained as were the Western nature and outlook of the Ionian Greeks, as testified by the nominal allegiance to Athens, the Eastern influences—Hittite, Mesopotamian and, later, Phrygian—to which they were inevitably subject, influences that even in Greece and South Italy were not unfelt, must in Ionia have been more effectual. The Etruscans on the contrary, if geographically of Ionian (Carian ?) origin, were, as we have seen, in racial qualities quite alien, far more grossly oriental: in their superstitions, such as those of divination which were a bane to Rome, gross and besotted. Thus by all these several and various sources of civilisation, by their geographical position and mode of life, by the fertilising effect of immigration and cross-breeding, and by an adventurous, trading, and roving life, the Ionian Greeks were blended into a peculiar and manifold community.

If still we marvel at the appearance of the humane and lucid spirit of this people, a spirit purged of superstition, witchcraft, and the grosser kind of myth, a spirit which, almost too good for this world, or for that, died young, we ask ourselves still how, or at any rate whence, it had its birth. Some answer to this question may be found in Professor Gilbert Murray's *Rise of the Greek Epic*. In more than one very interesting chapter he illustrates from the *Iliad*, the dawn and spring of this spirit as it rose and divested itself of the hazy, barbaric, or bestial elements of the earlier legends and myths. The fear of ghosts is not to be found in Homer; the Homeric temper ignored, and almost expelled, devilry, magic, sorceries, and hocus-pocus purifications.[1] Homer brought his gods down to mankind and gave them sympathetic passions; yet Rome a thousand years later was deifying its Emperors: and after another millennium an Emperor of modern Germany claimed divinity, at least for his throne and functions. If it be demurred that the *Iliad* was probably not Ionian yet it was certainly Greek; and Professor Murray reminds us that, at least as early as the eighth century, it was the grammar of Ionian youth; the standard and organ of their education: so that this people was nurtured on a humane and chivalrous ideal, and " a low intensity of superstition."

Miletus, a city called by Herodotus the ornament of Ionia, and said to be a Cretan—late Minoan—colony, a legend supported by some evidences of excavation, gave birth to Thales, " the first man of science." Herodotus himself had this same open and curious mind, and the Halicarnassians are spoken of more than once with the men of Cos. We know that Miletus and Rhodes, maritime islands which may be regarded as typical of Ionia, had wide intercourse with Egypt, Asia Minor, Lydia, Sardes, the Euxine, and Babylon.

Thales (640–548 B.C.), a practical engineer, a man of affairs (Arist. *Pol.* ii. 4), a mathematician, and an astronomer who was able to predict the solar eclipse of 585 B.C.,[2] has been called the first man of science; he was the leader of those Ionian sages who first conceived a natural cosmogony independent of fable and supernatural machinery; an evolutionary cosmos originating in primary endowments of matter or substance. These sages—the Cosmogony of Thales was meagre but was a beginning—conceived that evolution began from some indifferent primary substance by separation into contraries, such as heat and cold, dry and moist, and other opposites (Anaximander). This primary substance might have been water (Thales),[3] or air (Anaximenes), or fire—a purer form of air or aether (Anaximenes and Heraclitus). Thales probably fixed upon water as an indifferent medium, one which by condensation might make earth—down to Lavoisier it was supposed that water on evaporation left a solid residue—and by evaporation air; but the full recognition of condensation and rarefaction, as functions of matter, we owe to Anaximenes; as to him we owe the first scientific observations on the rainbow—the invariable order of the colours, and the relative position of the sun throwing its rays on moisture. To him also we owe the comparative ratios of wind and birds' flight; while, as we shall see, we owe to Empedocles the notion of polarity, of attraction (φιλότης) and repulsion (νεῖκος, p. 101). But, of these and such attributes, we must remember that the ancient philosophers regarded them not, or not only, as qualities but primarily as entities; for them attraction and repulsion, like heat and cold, and weight and levity, were entities, mysterious and rather ill-defined and inaccessible, but still agents. And although Descartes, and after him Newton, by definitions of mass, force, inertia, impulsions, quantities, forms, and geometrical positions of motion, banished the entities, restating them as qualities of energy, yet we still hear men speak of the electric fluid, as our great-grandfathers spoke of phlogiston and "caloric," and as some modern physicians speak of diseases as "entities." Thales again was one of the first men of science to apply theory to practice, as in the application of astronomy to the practice of seamanship. It is said that he was the first to fix upon the pole star as the sailors' beacon; but the sailors were probably before him. Nothing of the writings of Thales had survived in the day of Aristotle.

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[1] On this point I would call attention in the *Odyssey* to the kind of purification of the hall after the slaughter of the suitors; not by ritual or oblation but by fumigation with sulphur, a scientific antiseptic method which, I think, has received little attention.

[2] I may remind the reader that nearly two centuries later Nicias, arrested by awe of an unforeseen lunar eclipse, so lost his whole army.

[3] The idea of Thales will be better understood if it is realised that by " water " was meant the germinal waters of Chaos, or every kind of fluid; including, for example, blood. The elements of his mathematics he derived from Egypt (Diog. Laert.), which however was probably little more than mensuration.

Perhaps *Anaximander* (611–547 B.C.) was the greatest genius of the Ionians; but materials for a full judgement are very scanty. "Yet without Anaximander," says Diels,[1] "no Pythagoras, nor Heraclitus." His writings were lost in very early times. He saw that the causal series in space and time was infinite; he raised the micro- and macrocosm idea from myth to reason—as the "breathing world," universal stream of energy, fusion of man, animal, vegetable, and inorganic kingdoms into one cosmos: a profounder harmony than George Herbert's: "Man is one

[1] Diels, "Wissenschaft u. Technik bei den Hellenen" (*N. Jahrbücher f. d. klass. Altertum*, 1914, B. xxxiii.), is chiefly concerned with mechanics, and considers development of mechanics and mathematics and engineering, great war engines from the bow onwards. The fury of war, then as now, fed itself upon science. Diels quotes Häckel as recognising "only three greatest philosophers of history ("abgesehen von sich selbst," as D. slily adds), viz. Anaximander, Anaximenes, and Wilhelm Ostwald. German modesty!

world, and hath Another to attend him." Whether as poetry, symbol, or synthesis, the ideas of the macrocosm and the microcosm ran through the centuries; all through the Middle Ages down to Boyle and Leibnitz. But Anaximander was no mere closet student: he gave much pains to a constructive geography, and was first to make maps, afterwards improved by Hecataeus (Diels); and he organised a colony to Pontus from Apollonia. Diels tells us also (*Vorsok.* p. 20, note 28) that he actually proposed as a theory of earthquake that it was due to the percolation of water into the fissures of the earth. Aristotle, if I remember right, attributed the heat of thermal waters to subterranean fires. Anaximander measured the rate of increase of river deltas, speculated on the elevation of mountains, and on the origin of life from the sea under the influence of heat. Xenophanes of Colophon about the same time, from observations of fossils, inferred that the earth had gone through periods of sinking into the sea and of emergence and elevation (R. and P. *in loc.*). To him in part Pythagoras owed his apprehension of the spiritual functions of man; and also the idea of evolution of opposites from the infinite. Under the fanciful names of "justice" and "injustice" he signified the encroachments of one element upon another, especially of opposites. Cold and heat seem to have begun in Anaximander their long career as natural principles; and this indeed not as entities, but truly as properties (πάθη) of varying matter.[1] A statue which was raised in Miletus to Anaximander is now in the Berlin Museum.

The treatise in the Hippocratic collection Περὶ ἑβδομάδων, (*On seven-day periods*—based upon the number of the planets), has long been regarded as a relic of early Ionian philosophy. Roscher says that it was written on the coast of Asia Minor; at Miletus perhaps, or Cnidus. The dialect is genuinely, not affectedly, Ionic; and the attachment of the author to this region as a centre of culture is manifest. It was written before the Persian war, while Sparta dominated all Hellenes, even those of Asia Minor; its ideas belong to the early period of Ionian culture, as of Thales, Anaximander, Anaximenes, and Pythagoras, but are especially suggestive of Anaximander. We find similar notions in some cuneiform inscriptions. The Περὶ φύσεως, which may be regarded as the earliest extant scientific treatise in greek, was more occupied, after the manner of Anaximenes, with vital air.

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[1] Diels, *Wiss. u. Tech. l.c.*; and *Frag. Aet.* v. 19. 4.

The Ionian sage who, if not the greatest of the band, yet concerns us most nearly in the history of Medicine is *Anaximenes* (610–545 B.C. ?), a disciple of Anaximander (Diels). He, with the same Ionian bent to definition and continuity, turned back to the older conception of air as the primary source of substance, motion, and life. Air was to the cosmos as soul to man, as mind to brain, and as the pneuma to later philosophies.

We can imagine how in their sunlight the air appeared to the Ionians; palpitating, vibrating and shimmering upwards into the sky. By condensation and rarefaction, a fecund idea, were formed the more static and the more dynamic substances; earth, water, vapour, air. Breath, the soul of the animal body, was air; what else then but air—the blowing breath (pneuma)—could be the quickening spirit of the macrocosm ?) *οἷον ἡ ψυχὴ ἡ ἡμετέρα ἀὴρ οὖσα συγκρατεῖ ἡμᾶς καὶ ὅλον τὸν κόσμον πνεῦμα καὶ ἀὴρ περιέχει* ("as our own soul being air sustains us, so pneuma and air embrace the universe"). As Empedocles, Diogenes of Apollonia (see Plut. *Plac.* i. 3. 6 and *Moral.* 876 A), and Heraclitus taught after him, fire was the finest and subtlest air. Thus expanded and interpreted by these philosophers, and after them by Leucippus and Democritus, air, breath, pneuma became in Rome, as we shall see, the leading principle of the sect of the Pneumatists, and entered largely also into the doctrine of the Methodists. Pneuma animated the blood and the heart, and, moreover, carried some apprehension of oxygen down the centuries till the days of Priestley and Lavoisier (p. 262).

Of Heraclitus, perhaps the loftiest, if not the most positive in genius of all these early sages, I will defer what I have to say until I come to consider their ideas of Motion (p. 112). Anaxagoras again belongs rather to the Aristotelian period (p. 119).

To turn back now to a very different current and order of thought, though it be likewise tempered by Orphic inspiration.[1]

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[1] Xenophanes (c. 576 B.C.), a mechanician, and a pupil of Anaximander (says Theophrastus), migrated from Ionia to Italy, settled at Elea, and founded the School of the Eleatics of which Parmenides was the most distinguished teacher.

Parmenides and the *Eleatic school* saw nature, as I have said, under a wholly different aspect; for them the scheme of things was one of fulness and permanence, to be consummated in the one *immutable* Being. To them nature presented not her dynamic but her static aspect. For the modern mind the Eleatic doctrines looked the wrong way: and are, comparatively speaking, of less importance in the history of science[1] except in so far as they influenced Aristotle and Hippocrates.[2] Notwithstanding, as, in the Eleatic view, nothing was either generated or destroyed, so in a sense it was Parmenides who postulated a doctrine of the conservation of matter, whatsoever its many shapes, manifestations, and inter-changes (*συμμίσγεσθαι* and *διακρίνεσθαι*, as afterwards Anaxagoras); metamorphoses due to the "separations and recombinations of primary elements or principles themselves, whether many or few, indestructible." His predecessors had indeed regarded matter as inexhaustible, being replenished from the *ἄπειρον* (infinite); but this is another argument. Thales had not reached the conception of matter and force as indestructible; Anaximander assumed the "Boundless" (*τὸ ἄπειρον*) to be no abstraction but a vast storehouse whence the incessant waste was replenished; which reminds us of Arrhenius' derivation of life from space: but a generation later Anaxagoras clearly held the sum of being to be constant; that things arose by combinations and dissolutions, being in their elements indestructible—the "*Omnia mutantur, nihil interit*" attributed to Pythagoras. Hence the transmigration of souls was conceivable. So far as in the rich fecundity of ideas among the Ionians particular doctrines can be distributed, and so far as monists could speak severally of energy and matter, we may attribute the doctrine of the conservation of matter to Anaximenes (who did not suppose its renewal from the infinite), and of energy to Heraclitus.[1]

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[1] The greater and more original side of the philosophy of Parmenides lies outside my subject.

[2] See Diels, *Vorsok.* and Littré vi. 466 *Περὶ διαίτης*. In the sixth chapter of the Fourth Book of the *Physics* of Aristotle the reader will find the current arguments about the spatial relations of matter (*τὸ κενόν*); how that emptiness might be an entity, or not; and, if an entity, like pneuma supplied from the Unlimited (*ἐπεισάγεσθαι δ' ἐκ τοῦ ἀπείρου χρόνον τε καὶ πνόην καὶ τὸ κενόν* (Pythagoras)). Aristotle says growth can hardly take place but by occupation of space not already occupied by another body; two bodies being unable to occupy the same space. However, for purposes of exposition, to outline the differences between schools of thought in strong colours seems inevitable; and in the present comparison has led historians into some exaggeration of them. Yet when we leave logic for life we find a good deal of grey in men's beliefs; black and white are not so vividly opposed as in logic (see *Empirics*, p. 166, and Mieli, A., *Scuole Ionica*, I., 1916).

II. The Italo-Sicilian School

An interesting phase of Ionian life is its return to its Italian home, on the migration of Pythagoras from Samos to Sicily. On one secret of the strong wing of Ionian physical speculation, namely its remarkable emancipation from the dominion or blend of supernatural ideas, I have laid no little emphasis. However, in Sicily Pythagoras, directly or indirectly a pupil of Anaximander, wedded Ionian physical and physiological ideas to a mystical type of religion which in some part came from Egypt, in some may have been primitive (see Pherecydes, *infra*), and in some the Latin Orphic. Out of this union sprang a long line of ideas half scientific, half mystical; again reinforced, or inflated, by later mystical and rhetorical currents from Egypt and the East.

Pythagoras (b. *c.* 582 B.C.) was perhaps one of the greatest philosophers the world has seen. Unfortunately he is for us but a vision in a mist. Concerning the education of Pythagoras there is an interesting story. If to Anaximander he owed his initiation into scientific thought, he is said to have been also under the nurture of a certain Pherecydes, an Aegean of Syros, and contemporary of M. Tullius the too facile guardian of the Sibylline books; from Pherecydes Pythagoras may have derived some of the more mythological parts of his creed. Pherecydes (*c.* 540 B.C.) with his chthonian serpent had not entered into the philosophical succession;[2] he was only a mythologist after the fashion of early peoples (Arist. *Met.* xiii. 47; Plut. *Sull.* 36); still to him is attributed the long dominant notion of the four elements – earth, fire, air, and water; so that we may call him a primitive naturalist. Like the gnomic poets, he had some Orphic vision of immortality, and built an ethical idea upon the subduing of earthly by celestial forces. Of this we know little, and it may not much matter; the interesting notion is that Pherecydes seems to have belonged to the old (Minoan ?) tradition, to have been a link with the remote past; and he may have conveyed some elements of hoary and theocratic myth, and the quality of an artistic and imaginative people into a cosmic school remarkable for a blend of new science and art with old mythology, as perhaps from Egypt and Chaldaea. Concerning this blend of religion and science, I have come across an interesting allusion to Pherecydes by a later writer (quoted Diels, *Vorsok.* 506. 1) as teaching that "anima" was twofold: one spirit from heaven ("de coelo"), the other terrestrial and seminal ("terrenis seminibus comparatum"). Now we know that Pythagoras conceived that even plants must have some share of a vital principle or spirit; what was called later the vegetative or nutritive soul, or pneuma (Peripatetics, Stoics, Galen). However we know that Pythagoras himself studied Egyptian, Phoenician, Babylonian, and Chaldaean sources at first hand; studies which may have owed their direction to an early bent given by Pherecydes, as certain of our modern prophets claim some measure of inspiration as an inheritance, personal or tribal, from an "Iberian" ancestry. Dr. Budge (*loc. cit.* vol. i. p. cli) says that Pythagoras was a pupil of one Un-nefer of Heliopolis; but he cites no authority. Furthermore, the Pythagoreans had a close connexion with Delphi; and Croton and Metapontum, cities in which the Pythagoreans most flourished, were founded from Delphi. Hence again we see that the Apolline ceremonies of purification, of harmony, and of healing were kindred ideas.

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[1] *E.g.* in the quasi-Sicilian Περὶ φύσιος ἀνθρώπου §7, a treatise in the Hippocratic Corpus attributed by Littré to Polybus, we read: *οὐ γὰρ ἂν μείνειε τουτέων ὀυδὲν οὐδένα χρόνον ἄνευ πάντων τῶν ἐνεόντων ἐν τῷδε τῷ κόσμῳ, ἀλλ' εἰ ἕν τί γε ἐκλίποι, πάντ' ἂν ἀφανισθείη· ἀπὸ γὰρ τῆς αὐτέης ἀνάγκης πάντα ξυνέστηκέ τε καὶ τρέφεται ὑπ' ἀλλήλων*—"for not one of these could subsist an instant without the totality of things in the universe; and if any one thing were to drop out all would disappear, for, in virtue of one and the same necessity, all are maintained and nourished by each other"). Here we find the sense of all things as interdependent; more than a glimpse of the conservation of matter and energy. For Lucretius the everlasting duration of matter is plainly taught; that by the atomic theory "the invisible activity, unbroken continuity and regular order underlying the abrupt revolutions of phenomenal existence" was explained.

[2] Smith's *Dict. Biog. in loc.*; and, afterwards, Burnet and others.

Of the work of Pythagoras no textual record remains; it is said that some of his writings were still extant in the Alexandrian schools, but it may have been that, as with Moses, Thales, Socrates, and even Hippocrates, his influence was wholly or mainly personal.[1] However it was about 532 B.C. that, probably misliking Polycrates, he departed from Samos and founded at Croton (529 B.C.) a colony, or rather a school or society, the precepts of which, in distinction from the secular schools of Ionia, were both religious and scientific. He is said to have been at least conversant with the cosmologies of Anaximander (*e.g.* with the idea of the infinite—*τὸ ἄπειρον*—the original stuff), and of Anaximenes (*e.g.* the infinite *air*); while on the religious side he may have derived the mystical element of his doctrine, as I have said, in part from the older Pelasgian tradition, and in part from the Orphic brotherhood, and more directly perhaps from Egypt and the East. The pythagorean mysteries, like the contemporary orphism, symbolised the immortality of the soul, and were not dionysiac, but ascetic and purificatory.[1] The lofty and beautiful contemplations of the *Phaedo*, and the poetry of his spiritual descendant Virgil, give us the afterglow of pythagorean doctrine. Music, in the wide sense of the word familiar to the Greek culture of that period, as a harmony of all functions, and thus finally significant of the highest philosophy, took a large place in the pythagorean society.[2]

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[1] Plato and Aristotle seem to have had only oral reports of the Pythagorean teaching from Philolaus (p. 232).

Gomperz speaks of the astronomy of Pythagoras as "original and brilliant"; that, perhaps by the phases of the moon, he recognised the spherical form of the earth, and the obliquity of the ecliptic, and may even have attained to the Copernican, or rather the Aristarchan, point of view. Now Aristarchus again was an Ionian, of Samos. Unfortunately, in the hypothesis of a revolution of the planetary bodies about an imaginary "centre of fire," the Pythagoreans seem not to have taken the sun as this centre.[3]

That in the pythagorean doctrines a large place was given to Numbers is well known (p. 37), and in a way to us rather incomprehensible. Professor Jackson speaks of Pythagoras a little hardly, as "a propounder of a fanciful theory of numbers"; but the geometry of the school was certainly sound and progressive. Modern mathematicians tell us that the Pythagorean and Platonic schools had made marvellous advances; and that they laid the foundations for the Alexandrian mathematicians.[4] And we must try to realise that, for those ancients, numbers were not the abstractions that to us they seem to be; for the Pythagorean a number was an entity, occupying space, moving in time, and, as such, exerting its own particular and constructional influence. He probably could not have put to himself a distinction between the ideas of numbers as the models and as the essences of things; though it was the "pattern theory" of numbers that for a while attracted Socrates. We may come a little nearer to this point of view by interrogating our own conception of a cubed number; for I think we shall all admit that in idea we are prone to give to the cube some notion of entity and solidity; as if, by cubing, the number grew and took a geometrical or constructional form. Sir William Ridgeway has suggested that a study of crystals may have led Pythagoras to his conceptions of numbers and limit; his father was a lapidary. Again, the theory of numbers and harmony signified and imparted a sense of Cosmos, of universal law, and even of molecular combinations and structures.[1] Not perhaps that things were numbers, but were built of numbers; as in the aphorism: Θεὸς ἀεὶ γεωμετρεῖ; and (in Frag. 4, of Diels) that all phenomena are numerical, and without numbers cannot be understood — *καὶ πάντα γα μὰν τὰ γιγνωσκόμενα ἀριθμὸν ἔχοντι. οὐ γὰρ οἶόν τε οὐδὲν οὔτε νοηθῆμεν οὔτε γνωσθῆμεν ἄνευ τούτου.* Is it indeed quite becoming for us, who have not given up taking words for things, to belittle the pythagorean admiration of numbers? As Jowett has said (*Introd. Timaeus*): "Numbers might well strike the imagination. They were the measure of all things, and seemed to give law to all things" (planets, music, physics, ethics; see Diels, *Pyth. Fr.* 4); "nature by their power was rescued from chaos and confusion. By them only can Science become 'exact.' The mysteries of number and music were akin; rhythm, harmonious motion, and Cosmos.[2] In harmony Aristotle (*De an.* i. 4) saw the combination and synthesis of opposites (κρᾶσις). Plato asserted the supremacy of mathematics. Of all scientific truths the uniformity of nature is the greatest and simplest, and of this the ancient philosophers had an unbroken conviction."

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[1] Metempsychosis arose out of a scheme of purgatorial purifications.

[2] For much in these philosophical paragraphs I am in debt to various authors; such as Ritter and Preller, Ueberweg, Zeller, Gomperz, Diels, Benn, Burnet, and others.

[3] A heliocentric or uranocentric hypothesis survived and even prevailed, for some century and a half, and then in the decadence of culture was lost again.

[4] See Sir T. Heath's *Suppl. Method of Archimedes, recently discovered by Heiberg.*

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[1] Aristotle realised chemical combination to the formation of new substances, but not perhaps the ordered proportion of the constituents (see Empedocles, p. 102). As illustrations of the harmonic structure of the Cosmos we may bethink ourselves of the periodic system of the elements discovered and calculated by Newlands, Meyer, and Mendeléef, the laws of plant spirals, and so forth. The pythagorean mathematics were developed by Archytas in analytical mechanics, and in music by Aristoxenus. Both Archytas and Aristoxenus were Tarentine Greeks.

[2] For the diatonic division of the heptachord see Stob. *Ecl.* i. 46, where the planets fill the part of the seven strings of the heavenly choir. See also Burnet's *Greek Philosophers from Thales to Plato.* Then, less pictorially, the Earth is of the cube, the air of the octahedron, fire of the tetrahedron, and so on.

Numbers or quantities lie at the root of all analytic methods ; indeed exact science has often been said to consist in measurements. In the well-known aphorism of Plato (*Philebus*) we read that when weight and measure are left out little of anything remains. Herein Pythagoras manifested the bent of Ionia to practical problems. But I think Gomperz overcharges his case when he says that the author of *De prisca medicina* (in the Hippocratic Corpus) laid down the axiom that measure is the basis of science (Littré i. 588). The author demands precision, it is true ; but in this context he is concerned with a subjective standard—the patient's reaction to a drug. But on the important analysis of sound by number and " limit " I may give an interesting example, one which has the interest of an experimental revelation of a principle which runs throughout the texture of the world ; namely, the discovery of its fundamental laws—the laws of the vibration of the length of a harp-string stretched by a weight, and of pipes, and of bells ; the numerical ratios which determine the intervals, harmonies, and concords of the scale.[1] Philolaus said that Pythagoras determined the principal harmonic ratios [2] but not the functions of frequency and amplitude of the vibrations. There is reason to suppose that the exact calculation and proportion of parts to the whole and to one another which in the later Greek architecture were carried to so amazing an achievement of intricacy, coherence, and refinement, were developed on the lines of pythagorean numerical harmonies—

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[1] "The luckiest hit," says Gomperz, "in the history of science," but we must make more of it ; it was the initiation of experimental physics. Pythagoras calculated the numerical ratios and musical intervals ; straining in some cases the assent of the ear. Aristoxenus, in the opposite extreme, said that the ear must dictate the arithmetical theory. Pythagoras seems to have initiated his experiments for the very reason that subjective standards were variable and fallacious. It must be admitted however that some of this testimony of experiment depends upon a late and more or less fanciful story of Boethius (*De instit. mus.*) ; how that Pythagoras, listening to the clanging of hammers on a smith's anvil, made hammers of different weights, and so obtained his diapason, sesquitertium, diatessaron, and so on. But Boethius probably went upon an old tradition, and the story is corroborated by allusions in Philolaus, Archytas, Aristoxenus, etc. In outline, at any rate, we do know that such results were experimentally obtained. But after these definitions Pythagorists went astray in mystical swamps. Pythagoras and Empedocles seem to have kept their science and their mysticism in separate compartments ; a contrivance not unknown amongst ourselves.

[2] See Arist. *De sensibus* iii. 439 b 31, and Archytas in Pauly-W.

"the secret magic of numbers"—as seen again in the examples of Bathycles, the Amyclean throne, and so on. Archytas of Tarentum (*c.* 400 B.C. ?), a contemporary of Plato, a Pythagorean, and a great and inventive mathematician, musician, philosopher, and statesman, who is said to have been the first to submit mechanics to mathematics (Diels, *W. u. T.*), and whose flying dove is mentioned by Aulus Gellius (x. 12), carried on the demonstration of the harmonic relations of tones and overtones. The works of Archytas and Aratus became school-books; but unhappily of Archytas nothing but doubtful relics remains. Although, when we think of the poverty, and the short series, of the Greek numerals it is not easy to see how an advanced mathematics could have been expressed by them, yet the discovery of harmonics, and the idea of the combining proportions of the elements, well rewarded the prophets of numbers; for on these methods all other systems of phenomena were thrown open to analysis and measurement.[1] The facts and bearings of the discovery of the string harmonies, calculations applicable of course to other series, are well brought out by Professor Burnet, who regards it as a cardinal point in the conception of law in apparent chaos; also as delineating form, marking out, so to speak, upon the unlimited (*ἄπειρον*), the "*Limit*" (*πέρας*). By the limit, or outline, things were carved out of the formless—"the perfect law of liberty." As Blake said "Truth has bounds, error none"; and Goethe: "Und das Gesetz kann nur uns Freiheit geben." For such minds as these the "infinite" was a mere negative; the good, or creation, began with the finite. Such then was the great contribution of Pythagoras to science, and the earliest record of experimental research in physics (see Plato, *Philebus*, ii. 2, 3). As the Milesians reached the conception of primordial energy and indestructible matter, so Pythagoras detected the law of measurable and calculable "form" (*εἶδος*), the innate self-building faculty and individual constitution; and this, not as a concept of mere speculative logic, but scientifically, by way of experiment. The doctrine of the "mean" (*μεσότης*), so intense in the Greek character, the avoidance of excess, arose directly out of, or with, this pythagorean sense of measure. Now in part by the way of music, as illustrated by the case of Saul, and of purification (κάθαρσις), the Pythagorean penetrated into the sphere of medicine; he extended "harmony" to medicine first, thence to conduct.

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[1] While these pages were passing through the press, the following extracts appeared in a leading article of *The Times*, Sept. 4, 1920: "A monistic interpretation of matter has displaced the older view. And what are electrons, these new symbols of the physical composition of the material universe? . . . They are mathematical abstractions. . . . **In the last resort matter has become number, a measure not a thing.**" We may add that Clerk-Maxwell had no evidence of electro-magnetic waves of the ether beyond mathematics, till Hertz made them visible.

Whatsoever then its mystical (Orphic, etc.) and magical elements, the kinship in genius of this Sicilian school to the Ionian and Hippocratic is well illustrated in medicine by the example of *Alcmaeon* of Croton, a younger contemporary of Pythagoras. This monumental figure in ancient Medicine, the first Greek medical author known to us, was indeed as plainly akin to the Ionians as to the Pythagoreans; and we see him emerging from myth as from a cocoon; from symbols to principles. He reinforced the scientific side of Medicine, while carrying over some pneumatist doctrine, probably from Egypt. He seems to have been unduly neglected by Aristotle; though we have to thank Theophrastus for the preservation of relics of his teaching.[1] Ritter and Preller do little more than allude to him. He dissected animals and possibly man, so it has been said;[2] if so he may have been the first human anatomist.

The problems of the special senses, and of generation, had a great attraction for this school. Alcmaeon was the first to extirpate the eyeball (Diels, *Vorsok.* 104); having presumably practised the operation upon animals, he described the several coats of the eye and, tracing the "channels" (optic nerves) backwards to the chiasma, realised the blend of binocular vision. The nerves he regarded, as Aristotle did after him, as channels of the air or pneuma, and found their origin in the brain; though he said the same of the blood-vessel; but the word he used (φλέβες) may for him have meant the arteries, as he uses the word *αἱμόρροοι* (blood canals) also, presumably for the veins. By "artery" he meant of course the tracheo-bronchial tree.

[1] In his treatise *De sensibus* Theophrastus has given a skilful summary of the doctrines of physical philosophers before Plato. The conception of relativity, expressed or implied long before (p. 116), is fully recognised. Theophrastus (see edn. Stratton, p. 57) was one of the first to formulate the Economy of Causes—the so-called Ockham's razor (p. 155); furthermore he pointed out that a theory must cover, not some only but all, the facts with which it has to deal.

[2] That is, if a comment of Chalcidius (sixth century A.D.) on the *Timaeus* be worth anything. Democritus followed his example. The Hippocratic schools seem never to have turned attentively to anatomy, probably for lack of opportunity. The author of the descriptive Περὶ καρδίης was of a later time. For Diogenes Ap. see p. 109.

Alcmaeon found water in the eye, and inferred, as did many others, from subjective experience—*e.g.* of a blow on the eye—that it contained fire also (Aetius iv. Diels 116). In vision the rays from the soul in the brain reached the object, and thence returned to the brain. This notion of vision, and much else, Empedocles took from Alcmaeon. A still greater conception of Alcmaeon was of the brain, or the finest air in it—cephalic or psychic air, as the seat of the intellectual soul, and, armed with its special senses, as the central organ of intellectual activity (Aet. iv. 17); wherein Hippocrates followed, but Aristotle strayed. This Crown of man was a note of the pythagorean schools.

Again, it is in Alcmaeon first that we find in some definition the doctrine, afterwards so prevalent, of the (three) souls. He distinguished between sensation and intelligence (τὸ φρονεῖν and τὸ αἰσθάνεσθαι). In his school the human body was quartered into four regions: (1) that of the head, as the seat of the understanding—the psychic function; (2) that of the heart (breast), of the animal spirits and of sensation—the animal functions or soul; (3) that of the "navel," the seat of growth and development (embryo)—the vegetative functions; and a fourth region—the pubic—which, presiding over generation, exercised a sort of universal influence. The ear Alcmaeon compared to a sounding-board or resonant chamber; he noted how the tongue, by its moisture dissolving sapid matters, ministered to the sense of taste. He taught that sense perceptions were fused together in the brain (*sensus communis*), associated into memories, these into inferences, and inferences into reason. Mental diseases he attributed accordingly to disorders of the brain, not of the heart, nor of the aorta or pulmonary artery. The well-spring of force he called Psyche; and to this vital principle, derived from eternal, divine, self-originating motion (see Motion, p. 112), he attributed all spontaneous bodily activities; a view closely like that of Plato, for whom the Soul was the source and spring of movement. Furthermore, upon the embryo he founded the conception of phylogeny, which he handed on to Parmenides; and he divined the sexual relations of plants. Disease Alcmaeon regarded broadly as a disturbance of the balance of bodily qualities; and in respect of the special senses as concussions or shifts of the conducting lines. Health was "isonomy" or equilibrium of the bodily parts and qualities.

He rationalised, as did the Hippocratic school after him, the causes of diseases, attributing them to external agencies—plethora, inanition, fatigue ; or again to dyscrases of the elemental qualities—heat, cold, moisture, dryness ; health being a true blend of opposites. This doctrine of the School of Croton was thence carried forward, in medical tradition, to be developed by the great Hippocratic school. In Alcmaeon the four qualities were regarded rather as external causes of disease. How admirable are these views ; admirable in truth of insight, and in emancipation from fantasy and convention ! It is true no doubt that Alcmaeon has been too much " modernised," as by Gomperz ; as Schultz says, we must " preserve the perspective of the past." [1] For example, his promotion of the brain to hegemony, if afterwards because it was the home of the senses, first arose out of a mystical or fanciful relation of the vault of the skull to the dome of the sky.[2] But the interesting and pregnant idea of man as the microcosm in concert with the universe as macrocosm, if half mystical, was a prophetic vision of the unity of celestial and terrestrial laws—the heavenly bodies being living things, of physics and physiology, of motion and life, and of the numerical ratios of concords and discords—the discords being the strife of the world resolved in the universe. It was in part by this same mystical or prophetic insight that Alcmaeon discerned the significance of phylogeny, the sex of plants [3] (Diels, *Vorsok.* p. 204), and the food in the egg for the expanding germ. Was not Goethe's interpretation of the flower as a modified leaf—original as it was to him, though he was not the first so to see it—likewise a semi-mystical insight ? [4] Unfortunately, by the humoral doctrines, and again by the arid formulas of Methodism, these fruitful conceptions were soon thrown back into confusion, or dogmatism.

From the early disciples of this society, always, as we have seen, with a medical bent, arose another Sicilian physician and scientific teacher worthy in some respects to stand beside Alcmaeon and the master himself ; or rather to take a great place of his own, namely *Empedocles*.[5] Of his writings some relics are extant ;[1] but, as recorded by Aristotle, they are obscure and not expressed in his own words. Empedocles embodied his doctrines in the form of poetry and, like Lucretius but in contrast with not a few other rhyming philosophers, was, so far as we can judge from the fragments, genuinely a poet ; for instance the Second Fragment in Diels which is fine both in idea and craft. Moreover, like Alcmaeon by whom he was much influenced, he was actually a physician, and a physician of renown. For example ; a plague broke out at Selinous due to the stagnant overflow of a river. Empedocles is said to have stopped the plague by restoring the current and draining the land.[2] Empedocles believed, with the Ionian seers, that all nature was a result of evolution from simple inorganic elements. As a biologist, he taught that the beginnings of life lay in undifferentiated substances (*οὐλοφύεις τύποι*), which were gradually differentiated into species of which the fittest survived. Herein, in part at least, he anticipated Aristotle.[3] We shall see, that, in harmony with the Ionian tradition in Sicily, Empedocles likewise was deeply occupied with the dynamic problems of the universe, and sought for moving (dynamic) as well as material (static) causes. He laid as a foundation the four elements—earth, water, fire, and air—in the animal, liquid and solid, warmth, and respiration—which he handed on, probably from Egypt, to many generations of men ; and he strove to read the riddle of the component forces which animated or impelled them. Under the names of Love and Strife (*φιλότης* and *νεῖκος*), similar to but not identical with the justice and injustice of Anaximander, he vividly portrayed the polar relations of matter, already apprehended in part by Thales ; relations which, in later times under the names of attraction and repulsion, have played so large a part in our conceptions of physical science. It was an attempt to get at a principle of causation, the next being the *Nous* of Anaxagoras (p. 120).

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[1] Schultz, *Altionische Mystik*, 199 ff. ; an interesting essay.

[2] See Plato, *Timaeus*, 44 and 73.

[3] This conception has been attributed to Empedocles.

[4] See Fuchs, *Handb. d. Gesch. Med.* Bd. i.

[5] It is interesting here to remember that Archimedes, in Dr. Heath's words " the greatest mathematician who ever lived," was a Syracusan.

Thus to Empedocles, as to the Ionians, we owe a deeper notion than many philosophers, even long after him, attained to, of the implication of motion in the molecular constitution of matter (pp. 115, 117); Professor Stratton[1] says the idea of "pores" (pp. 104, 106) can be traced to no earlier source. Moreover he also attained to some perception of the conservation of energy, or of matter—which may, or may not, be regarded as the same thing. It is usual to speak of the Ionians as materialists because they consistently interpreted phenomena by order, law, and measurement; but Pythagoras, when this interpretation was first experimentally proved, and the Sicilian school, Empedocles above all, held opinions on the spiritual side of life which have led Sir James Frazer to compare Pythagoras with Buddha; others, perhaps with as much reason, have regarded him as a flighty and fantastic genius. Albeit, there was in these imaginations not only much profound insight but also a sane and practical method. Empedocles made a far better use of his four elements (or six if we include "Love" and "Strife" as entities) than did many of his descendants; for not only did he adopt the great Ionian conception of the progressive diversity of phenomena from a primordial unity but, inspired by the pythagorean theory of numbers, he seems also to have referred the variety of character in objects to various combining ratios of the elements of which they were built; if so, he made some forecast of the Daltonian theory.[2] For him the combining ratio in each was its "form"—perhaps the only quite definite concept of "form" in Greek philosophy (p. 128).

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[1] See Ritter and Preller, *in loc.*

[2] Diog. Laert. viii. 70. Two coins of Selinous (Hill's *Coins of Anc. Sicily*, p. 84, etc.) show, *inter alia*, the river god offering a cock to Aesculapius.

[3] That any of these early thinkers anticipated Darwin cannot be argued ; as Mr. Benn said, all the ancients regarded species as fixed. Aristotle had no idea of natural selection as a principle, or cause. If the square pegs found square holes they survived, if not, not. The great Albert of Cologne, however, following an early tradition, gave instances of one kind of tree changing into another ; for example, an oak into an aspen ! (See Darwin, *O.S.* p. xiii, n.)

Again, Empedocles discovered atmospheric air, as a substance distinct from space and from vapour. He showed experimentally how air could keep water out of, or hold it up in, a vessel or tube. To his ideas on respiration and the circulation, as not very lucidly handed down to us by Aristotle, I shall have to speak later. I will say here only that Empedocles originated the notion of the circulation as a flux and reflux, tides inherent in the nature of the blood, which Aristotle compared to the tides of the Euripus; a notion that prevailed until Harvey revealed the secret.

Finally, it must be admitted that about Empedocles, the champion of contraries, there appears an environment of vainglory, fanfaronade, and delusion, yet with perhaps the first note of scepticism; a distrust of the human powers of attaining real knowledge (see Ritter and Preller, *loc. cit.*). An interesting appreciation of Empedocles, on familiar materials, is to be found in Sir James Frazer's *Spirit of the Corn and Wild* (Part V. of *The Golden Bough*).

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[1] *Greek Physiol. Psychology*, p. 164.

[2] See Kranz, W., "Empedocles and the Atomic Theory," *Hermes*, xlvii. i.

Upon the notions of these ancient thinkers, already alluded to, concerning the special senses, I shall not dwell at much length; they were mere conjectures which could not then, however tentatively, be brought under scientific tests. Suffice it to say of vision, that the Pythagoreans held that vision was an outgoing act. Empedocles seems to have held the same opinion, or perhaps to have postulated both an outgoing and an incoming process. As to hearing, Plato and Aristotle supposed that flights of air fell on the ear like missiles. Later philosophers (as Alcmaeon before them?) regarded vision as ingoing only, from the object to the eye.[1] In medieval, and even in Renaissance Optics objects were supposed to be continually emitting images ("species") of themselves, and the so-called "visual spirits," receiving these from the retina, caused visual perception. For instance, the "species" of a fixed star, to reach the human eye, had to penetrate the seven spheres of the planets and finally our atmosphere.[2]

The best known theory of vision,[3] the sense on which in this period the minds of philosophers were most exercised, was that the image which came into contact with the organs of sense was an emanation, or film, of fine atoms thrown off from the surface of the visible body. Plato thought that certain elements fitted into the passages of sensation; the theory of Democritus assumed certain imprints upon the air. Descartes thought our eyes received real images, and transmitted these to the brain. But in travelling through the atmosphere an emanating image was apt to undergo change, and thus to become unlike the object whence originally it proceeded; *e.g.* the edges of a distant square tower might become rounded off, and so on: moreover coalescence of fractions of emanating images might cause apparitions of monsters, or chimaeras such as centaurs. Again, even after the original had ceased to exist, its emanations might still wander; thus in dreams the dead might seem to revisit us. This simulacral theory of vision Plato perhaps accepted,[1] although for hearing he preferred that of Pythagoras.

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[1] See Beare's *Greek Theories*. Also Stratton's *Theophrastus* and review of this in *Class. Rev.*, 1918, by the present writer. The corpuscular hypothesis of light—one not so irrational as often supposed, and supported even by Newton—held the field until the nineteenth century. Then during that century the undulatory hypothesis won so strong a place as to be regarded as settled law or theory. Yet in the twentieth century certain profounder observations, out of place here, have startled physicists into some apprehension of a corpuscular hypothesis in a new form. These great shifts of scientific opinion and phases of thought form a part of the lesson of history.

[2] See Singer, "C. Fracastorius," *Ann. Med. Hist.* i.

[3] See Gomperz, Benn's *Gk. Philosophers*; and other treatises on the subject. Benn judged Empedocles a little more hardly than Gomperz does. See also Stratton, *loc. cit.*

Of a like kind was the *ἀποτύπωσις* doctrine of Democritus and others—that the object *stamped* itself upon the air, so as to form a mould which floated up to the eye. Theophrastus mocked at this notion, replying that such models would enter the eye backwardwise. However, hypotheses of this kind, vision by means of *εἴδωλα* differing in detail only, long held the assent of the thinkers of the age; in spite of the obvious objections that the air would be a wilderness of jostling *eidola*, that they would be unable to go round corners, would evanesce, and so on.

But the interpretation of the special senses varied of course from school to school, and from time to time. To Empedocles I have attributed the idea of pores; such inter-molecular passages, larger and smaller, straighter and more crooked —the *εὐθύτροπα* being *διαυγῆ* (clear) (see Plato, *Meno*)—became a common conception among physiological thinkers, and in the Methodist and Pneumatist schools dominant. For instance, Empedocles conceived that in cutaneous respiration there was bodily communication with the external air by pores that admitted the air, but were too fine to allow the passage of blood. Aristotle thought that a like porous condition allowed sweat to pass but not blood. It was supposed that while the particles of all the senses (*ἀπορροαί*) were of the finer magnitudes (*e.g.* of the psychic pneuma), the particles of sight and their pores were still finer than of the others. These particles—*e.g.* of sight pneuma—rose from the heart to the brain, thence passed by the optic nerves (which were supposed to be tubular, some at least of the nerves Herophilus called "pores"), to the lens, and through the pupils to the object. The lens in many schools was regarded as the chief limb of the eye. The coarser particles of taste passed in a similar way to the moist and soft tongue

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[1] The passage in *Theaet.* 156 is very vague.

(Alcmaeon, Diogenes Ap. and others). The ear was variously regarded (D. of A. and Anaxagoras) as a mere channel to the brain, or as containing apparatus for hearing in its own structure (Alcmaeon and Empedocles). The "cephalic or psychic air" (p. 90), the supposed medium of sound, whether it was here too thick, there too thin, and so forth, was a whimsical notion, though it lasted long enough. Two glimpses of truth indeed concerning the senses the Ionians did attain and uphold,—that, as Democritus also taught, the special senses were developments of the sense of touch, and that they had their psychic seat, not in the heart but in the brain.[1] The Parmenideans and Eleatics seem to have been of the same opinion. Telesius, in the sixteenth century, seems (*De nat. rer.*) to have adopted the tactile derivation, though oddly and unhappily, excepting hearing!

A brief allusion is sufficient for Empedocles' colour notions allied to the four humours: bile as yellow, blue as spleen, red as blood, white as phlegm. Democritus seems (Theophrastus, *De sens.*) to have founded some colour hypothesis, more legitimately, on molecular physics. We may see some such suggestion in the *Timaeus*.

The need of some centre for the co-ordination and clearing of all the sense impressions—the "*sensus communis*"—does not seem to have been realised by the older sages, unless it were by Alcmaeon. Plato, in the *Theaetetus*, was perhaps the first to define this idea—that we see *with*, but not *through* the senses. The *Nous* of Anaxagoras followed, but scarcely seems to me to contain the idea; his *Nous* was not a bank for the deposits and blends of aesthesis (p. 120). The *γνώμη σκοτίη* and the *γ. γνησίη*—perception and thought—of Democritus scarcely convey the idea of sensory synthesis.

An eminent example of the concert of the Ionian and Sicilian Schools (p. 92) we have in the development of the *Atomic Theory*, a concert made the more striking by the apparent lack of mutual influence in other quarters; for instance, by the lack of the influence of Democritus upon the great fourth-century Schools of Athens. Yet it was by the conjunction of the atomic idea of *Leucippus* and *Democritus* with the numbers and figures of Pythagoras that the atomic theory was constructed. The atomic idea seems to have sprung away, as it were at a tangent, from the Eleatic idea of universal solidity, and therefore of universal rest; for where were no spaces there could be no motion, and no becoming (p. 91); a static attitude which, as we have seen, was to the Ionian mind intolerable. In the fifth century Leucippus, an Ionian presumably of Miletus, and Democritus of Abdera, who by the way was something of a doctor and made dissections, agreed that mass, which might in appearance be as solid as we please, was plural, and that between its numerous particles were voids (*ἐτεὰ δὲ ἄτομα καὶ κενόν*, Democ.). And as the particles, if solid, must be infinitely minute, so, then as now, thought pierced its way to indivisible atoms moving in voids, voids which were really voids, not air spaces only; for air, like other substances, itself consisted in atoms and voids. These atoms were infinite in number, hard and immutable; but various in shape, in order, and in inclination (*e.g.* as Z or N), and at first moving all ways like motes in the sun; their pores or channels were wider or narrower and more or less oblique or zigzag, so that function consisted *τῷ ἐναρμόττειν τοῖς πόροις*—in the interplay of atoms and pores. Thus they were shepherded into orders, *ἰδέαι*; which remind us of the pythagorean numbers and figures, of the blend or mean. For void we now say "ether." In the voids the atoms were supposed, as we now suppose them, to be in incessant activity, colliding and causing vortices; so that out of impacts arose relative weights; absolute weight being thus rightly discredited: a wonderful subtilty of physical thought for that age. How far Democritus conceived of atomic activity as heat it is hard to say; but he was very near it, for he considered heat as identical with life and soul. This Aristotle did not quite admit; but agreed that heat was a necessary (inseparable) agent, and a common measure; *i.e.* the more heat the nobler soul (*De resp.* cap. 2). It is then an essential condition of an atomic theory, in any dynamic sense, that there shall be void spaces wherein the atoms may vibrate or fly. It is a very remarkable point that Pythagoras contrasted finite void with the infinite—*ἐπεισάνεσθαι ἐκ τοῦ ἀπείρου χρόνου καὶ πνοὴν καὶ τὸ κενόν* (R. and P.). Of the solid and full matter of Parmenides no interstitial activity could be predicated. Bacon (*Hist. densi et rari*) was Eleatic. He says:

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[1] See Theophr. *De sensibus*, 26.

"There is no vacuum in nature, either collected or interspersed. Within the bounds of dense and rare there is a fold of matter by which it folds and unfolds itself without creating a vacuum."

The first idea of Democritus probably was, as I have said, that the atoms floated or flew in all and any direction, as motes in the sun; but as the larger atoms having larger mutual impacts would be retarded, and the smaller atoms quickened, vortices, "by a sieve-like process," would distribute the atoms of many and various sizes through channels of various diameters and directions.[1]

Ritter points out that the variety of the speculative hypotheses of contemporary or almost contemporary sages, pursuing their courses in apparent unawareness of each other as in this case of Democritus and Parmenides, suggests, as I have also said elsewhere, that, whatever the intercourse of trade in the mid-fifth century, communications between some of the intellectual schools seem to have been rare and casual.

Still, let me repeat, this idea of atoms of Leucippus, and Democritus did not alone suffice for the atomic theory, an essential part of which is the law of evolution by relative proportions; a consummation to which the Pythagoreans contributed the theory, not in speculative terms only but also as founded upon experiments on musical scales and concords, and on the combination of vibrations into figures (*ἰδέαι* or *εἴδη*—individual constitution), as when, under the bow of a violin, powders on a drum-head sort themselves into figures (p. 96).[2]

Thus by a vast leap the Ionian school rose from the earlier notion of fortuitous showers or swarmings of motes, to the orderly conception—the theory in a word—of atoms and atomic combination (*ποία σύνοδος*); a conception with which our physicists are at home to-day. But, though the difference of mixture (*μῖξις*) [3] and crasis were widely recognised, the ancients did not, hardly could perhaps even in idea, conceive that it was by recombinations of the severally ordered proportions of their constituents that the formation of new substances took place. Aristotle realised no doubt, as I have suggested indeed of Empedocles (p. 102), that new bodies were formed, if we may venture to say so, by a chemical combination, so that the qualities of each constituent disappeared in the qualities of the new body; but even he did not imagine this conversion, or crasis, as consisting, as Pythagoras and Empedocles had half divined, in a recombination by definite proportions, nor perhaps by preferential affinities, as in the love and strife of Empedocles.[1]

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[1] How perennial are ideas we see in the words of Borel who, says Dr. Singer (*J. Roy. Micr. Soc.*, 1916), was the forerunner of microscopical research: "Parenchymatous organs," Borel said, "are full of little structures (*organula*) . . . like sieves [whereby] nature arranges the various substances according to the shape of the holes. "Passage is thus given only to atoms of a certain shape" (*Obs. Microsc. Centuria.* The Hague, 1656).

[2] Professor A. E. Taylor in a note on *σχήματα* as meaning just "atoms" (Stratton's Theophrastus, *De sensibus*) says Democritus also named them *ἰδέαι* or *εἴδη*. Now as *σχῆμα* and *εἶδος* are terms from Pythagorean geometry, meaning originally regular figures, we have in these terms signs of an historic descent of atomism from the Italian philosophers.

[3] From a mixture, in the strict sense (L. & S.) the several substances could, theoretically, be again separated. They might indeed in the mixture retain a mutual repulsion. But the word was used more widely than this: *e.g.* mixture of pneuma with vapour, or

Quite otherwise, and far more artificial, is the notion of Anaxagoras and others, even of Anaximander, of primary matter, not as simple atoms or molecules but as pictures in small of the visible wholes, or of particular tissues; minute preformed portions of like nature and quality to their respective parts (ὁμοιομέρη); and of development as a sorting of these specific units and a distribution and combination of them, each to its own kind. In this view the several parts of the living body—for instance bone, muscle, brain, and so forth—were divisible into molecules of like nature and structure to the whole of each; the parts being nourished not directly by assimilated air, earth, etc., but by the fitting in of these particular and individual organised particles—organised out of chaos, for example, by *Nous* (p. 120) the subtlest of all things—which correspond to the structure of each; a process which may be roughly compared with the "assembling of parts" in a machine shop. This notion reminds us of the similar, and possibly no less transitory, modern doctrine of inheritance by means of structural units in the germ or chromatin that represent particular characters in the body. As to the soul-atoms, Democritus contemplated their escape

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even its variation in creatures or parts of them, threatened its value as soul; its value as fine, pure, and ethereal, one with the nature of the stars. So ἀμιξία came to mean purity.

[1] So I supposed when I wrote this lecture. But on turning again to the *De anima* (i. v. 410 A) I find that Aristotle says: "For the elements are not combined in any haphazard way to form this thing or that, but in a fixed ratio or combination. . . . It is of no use for the elements to be in the soul unless also it contains their proportions and the mode of combining them" ὁμοίως δὲ καὶ ἄλλο ὁτιοῦν τῶν συνθέτων· οὐ γὰρ ὅπως οὖν ἔχοντα τὰ στοιχεῖα τούτων ἕκαστον, ἀλλὰ λόγῳ τινὶ καὶ συνθέσει, . . . οὐδὲν οὖν ὄφελος ἐνεῖναι τὰ στοιχεῖα ἐν τῇ ψυχῇ εἰ μὴ καὶ οἱ λόγοι ἐνέσονται καὶ ἡ σύνθεσις κτλ. But it is true that the whole context is too abstract, or even fanciful, to bear much superincumbent commentary.

by the pores, etc. ; but that they were replaced from without by inspiration ; and he seems to have surmised that the heat of the body was somehow due to the respiration. This notion persisted, if on the wane, to the day of Haller, who conceived thoughts as consisting in active spirituous ethereal particles passing from without through lung to heart, and from heart to brain.

Diogenes of Apollonia, who flourished about 430 B.C., is an interesting person to the historian of science, not only as, like Diogenes Laertius, a valuable witness of tradition, but also as a far more intelligent and clear-sighted thinker.[1] I have suggested that an eclectic is generally a dull person ; he lacks character, his ideas are not fresh, they are not fused into a new individuality ; yet from his mosaic we may collect more of the past than from the works of a more isolated philosopher. Furthermore Diogenes, who was a physician (" Er war jedenfalls Arzt," Krause), has this interest for us, that, although in Athens he was of the so-called " sophistical school," he was enlightened enough to oppose the inflated ingenuities and quips of the Sophists, and to support a movement of the time to save the decadent Ionian science, and indeed to reanimate it with some later ideas. He and Philistion may be regarded indeed as two of the founders of the more formal doctrine of the pneuma (Chap. X.). The air, or pneuma, of animals was a peculiar kind ; warmer, and specialised in quality for each. With his brethren, he supposed all life to have been engendered in sea-slime. Diogenes exercised no little influence over the Coan school, as Philistion had done in Athens upon Plato and Diocles. Like Anaximenes, whose pupil he is said to have been but whom he cannot actually have heard, he took air to be the primary stuff and all-penetrating " soul of life " (*νοῦς βροτῶν*—aether being the spirit of Zeus) ; he supported the doctrine that the soul-air was the thinnest air,[2] from which, by expansion, condensation, and differentiations (*ἑτεροιώσεις*), all phenomena arose. To this doctrine, as we shall see (p. 120), Anaxagoras added *Nous*, as a fabricating principle, and herein departed from the Ionian monism. But Diogenes regarded respiration as oro-nasal only, as did the Coan school (Περὶ ἱερῆς

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[1] Recently well edited, with Introductory Essay by Krause of Posen, 1908–9. This Diogenes is of course to be distinguished from the (later) Stoic. *Vide et* Diels, *Frag.* in ed. of *Excerpta Menonia*, Berlin, 1893.

[2] See Aristotle, *De an.* i. 2, 405-21.

νούσου 47); not as a function of the pores of the whole body, as Philistion and other Italo-Sicilians supposed. Later writers have attributed to Diogenes the doctrine of the pneuma as an entity, like phlogiston, between air and fire; but probably not quite accurately.[1] Dynamically, he also held the doctrine of the strife and blend of opposites.

Besides his medical writings Diogenes was something of an anatomist; he described the blood-vessels passing to the left ventricle of the heart (*κοιλία ἀρτηριακή, ἥτις ἐστὶ πνευματική*), and regarded them, as did Praxagoras of Cos (pp. 150, 302) a century later, as air channels; he described also the *vena cava* with its main offsets (Aetius, iv. 5. 7). The Alexandrians dissected man for the first time; before them only the inner (visceral) vessels—the hepatic, renal, splenic, etc.—as seen in animals under the butcher, or in sacrifice, were described. We are not informed that in the time of Diogenes even animals were dissected, in our sense of this word; yet, as I have said, Diogenes was something of an anatomist: indeed to the description of the blood-vessels inserted by Aristotle in the third book of the *History of Animals*, one of the oldest anatomical descriptions we have, he seems to have made an original contribution;[2] at any rate in this respect his anatomy was better than that of Syennesis, or even of Polybus. He was an advocate of venesection, an observer, though not the first, of the tongue and pulse (*φλεβοπαλία*) in disease,[3] and a recorder of blindness as a result of a tumour in the brain. He wrote also a treatise in Ionic—*Περὶ φύσεως*—as we should say *On physiology*; of this little remains (see Aristot. *Hist. an.* bk. iii.). He differed from his senior contemporary Anaxagoras on certain arguments, but agreed with him, or went a little beyond him, in regarding *Nous*, as indeed the earlier Ionians virtually had done, as implicit in the aery element, and developed in the course of evolution; primary air—"soul-air"—being potentially thought-stuff. Thus Diogenes tried to make the air of Anaximenes cover the *Nous* of Anaxagoras. This finest and most mobile matter was in different persons of various consistency; but the finest and subtlest of it was around the sun. The rhythms of the air were the basis of all the harmonies of the world (see Pythagoras, p. 95), and thus of all mind and soul activity; and air was the medium of the special senses. Diogenes perceived, as other philosophers such as Democritus and Anaxagoras had done, that gills were the equivalent of lungs, so that fishes breathed the air dissolved in the water. This homology Galen gives explicitly; and it seems not altogether to have escaped Aristotle, though for him the process, as in the lung also, was a cooling function of the water streaming through the gills, not of the air in the water (see Arist. *De resp.*). Diogenes also pointed out the absence in the fish of a windpipe, or other aerial channel, for the escape of foul exhalations.[1] He made moreover the acute reflection that even iron, and earth, "breathed"; for in the fire they lost weight, and rusted in the damp air, or under the influence of acids.

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[1] See E. Krause, of Posen, *Janus*, xiv. 4. 228, and 7. 570 and *seq.*, 1909. Also Diels, "Leucippus and Diogenes," *Rhein. Mus.* xlii. (1887); and Wellmann in Pauly-Wissowa, Likewise brief review by the present writer, *Class. Rev.*, Nov. 1910. His ideas approached the "immanent Deity" and "mind-stuff" of our own generation, but logically rather than actually.

[2] See Neuburger, ii. 223 n.; and *Janus* 1909, p. 725. Diocles had no little reputation as an anatomist (p. 137; and see Alcmaeon, p. 98 n. 1).

[3] See Theophrastus, *De sensibus*; and this book, p. 301.

In philosophy, like his Ionian predecessors, he was a monist, making no sundering between mind and matter. We shall not be surprised to learn that Diogenes regarded thought, not as a faculty seated in heart or brain, but as a universal bodily function fed by the air in the vessels; its intensity being directly as the full penetration of the air, and the purity and dryness of it.[2] On the other hand, like the author of the *Περὶ ἱερῆς νούσου*, he regarded the brain as presiding over the intellectual functions; the heart serving only for the circulation.

Diogenes was, it is true, a second-hand sage; but he claims consideration as an able representative of his time, and as a source or rather a channel of important Romano-Greek sectarian doctrines (see Menon, p. 243).

Forgive my long emphasis on these ancient and several speculations, as without them Medicine in Rome cannot be understood. Mr. Zimmern, in one of the less happy phrases of his interesting *Roman Commonwealth*, says that "exclusion from politics reduced (!) the Ionians to talking metaphysics." It is true that in political thraldom the greater Ionian inspiration waned; but, if exception be made of Heraclitus, who was a metaphysician before metaphysics, and seems to have had no overt disciples, before Aristotle neither the name nor the subject of metaphysics was distinguished ; if the Ionians talked in any differentiated category, it was surely in physics. I may remind the reader of Bacon's truer perception of the ideas of Heraclitus, Empedocles, Anaxagoras, Leucippus, and Democritus ; that they " have about them somewhat of natural philosophy, and savour of the nature of things, of experience, and of corporeal reality, etc." (*Nov. Org.* i. 63). Indeed later Hellenic speculation, except for a while in the Aristotelian and Alexandrian nature schools, became not more but less scientific. Athens, as I have said, was never at any time a school of natural science ; the atomic theory took no hold there, and consequently dropped out of sight till Epicurus restored it. Anaxagoras, a contemporary of Empedocles and a little older than Democritus, though long enough resident in Athens to have been the master of Pericles,[1] soon resigned his school to Archelaus, among whose pupils was Socrates. Archelaus in his turn soon left Athens, and founded at Lampsacus a flourishing school, in the leadership of which he was succeeded by Metrodorus (of whom see p. 142). Socrates in his early life did, it is true, study physics ; and the " pattern " theory of numbers, inherited from the pythagorean school, entered into the growth of his mind, as did a certain colour of pythagorean mysticism ; but in his maturity ethics overflowed every other subject of his thought. It is said that he was happy to hear the word *Nous* in the teaching of Anaxagoras but vexed by his inconsistent use of it. Aristotle seems not to have been attracted by the idea of *Nous* in this natural sense, nor did he suggest what might work in and behind " nature " (*ἥ τοῦ ὅλου φύσις*) to give it harmony and end. Surely, as W. Ogle pointed out, the extra-cosmic god of the *Metaphysics*—the unmoved mover (p. 113)—could have no such influence. The truth is, the strength of Aristotle lay in his avoidance of adventure beyond phenomena, and their arrangement in series.

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[1] For a fuller description see Aristotle, *Hist. an.* (511 b) as translated by Professor D'Arcy Thompson, Oxford, 1910.

[2] See Diels, Wellmann, etc. *in loc. cit.*

III. MYSTERY OF MOTION

Let us now return to scientific speculation in Ionia, especially to the idea of Motion upon which fundamental concept depends much of the fabric of their scientific visions, and much of the interest of these for the later historian. Ionia thus advanced from asking what a thing is to the more fruitful inquiry of what it does.

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[1] See *Class. Quart.*, Ap. 1917, xi. 2.

To the wondering eyes of the early Ionian philosopher Motion was the marvel of marvels: at first sight he marvelled at the activity, apparently spontaneous, of living things; and then, as his insight deepened, at an inward motion animating all matter, travelling and quiescent, organic and inorganic. For the ancients, even for Aristotle, the heavenly bodies were lovely, worshipful and perfect, as "sublunary" things were not; they had a spacious and splendid life of their own (see Plato, *Apol.* 26). The tale of Anaxagoras that the Queen of Heaven was but an earthy body, shining by reflected light, was "a horror to the orthodox."

Now if these heavenly bodies moving in their courses were not living things their motion must have been derived, as is that of a stone in flight from a living hand. Nay, even then, when the sage threw a stone, he began to ask himself whence in himself arose the motion which hurled it? In the prophetic vision of Heraclitus everything was flowing; but whence this vast and immortal energy?

> (In) the round ocean and the living air,
> And the blue sky, and in the mind of man:
> A motion, and a spirit, that impels
> All thinking things, all objects of all thought,
> And rolls through all things.
>
> *Tintern Abbey.*

As the living being must derive its motion from some ulterior source, so in thought we are carried back to a conception of some prime mover, unbegotten, infinite, indivisible, self-moving, but itself unmoved from without; communicating impulses by the mere fact of its radiant existence; unconscious perhaps of its own virtue.[1]

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[1] See the well-known passage in the *Phaedrus* (245 C) and Cicero's rendering of it in *Tusc.* § 24: "Only that which is the self-moving, never-leaving self never ceases to move, and is the fountain and beginning of motion to all that moves besides." Therefore indestructible—immortal. And (*Timaeus* 89) Plato calls this mover "soul"; we call it ether. How perpetual was this idea we may discover in the works of later philosophers, *e.g.* Boethius: ". . . stabilisque manens das cuncta moveri," *De cons. phil.* iii. ix. When the worshipper sings from *Hymns Ancient and Modern* (No. 11):

> "Who dost, thyself unmoved, each hour
> Through all its changes guide the day,"

he may be unaware of the profound antiquity and signification of the terms he is using.

Now we may turn back to *Heraclitus*, the apostle of motion ; a philosopher inspired by Anaximander, and more or less indirectly by Pythagoras and Alcmaeon. Although he scorned the science studies (" πολυμαθία ") of his countrymen, and was an uncompromising transcendentalist (Diels), yet he likewise started from a physical basis ; he declared still more vehemently the fiery nature of the finest air, and that soul, or pneuma, is fire. He developed this idea of a " be-souled " ethereal fire, which was the finest air ; this essence, the most real, living, moving, and directing ethereal spirit (γνώμη, τὸ σοφόν), turned form-wards, and death-wards, into vapours, waters, and earths (*i.e.* into fluids and solids) ; *combustion being the key to life and the world.* Speaking broadly, the ethereal and fiery substances had their home in the outer spheres of the universe, the home of the sun (which was pure fiery ether), the fixed stars, and the (five) planets. In the " sublunary " sphere the divine essences mingled with " baser humours," and towards earth became " thicker and more turbid." It is equivocal to speak of these Ionians, and of Heraclitus particularly, as " materialists " ; they were for the most part " monists,"[1] and regarded the finest, rarest, and most mobile particles as potential matter and soul—" mind-stuff "). Heraclitus then drew no distinction of origin between physical and psychical elements and processes ; although man was nature's masterpiece yet he was involved in cosmic law. As Francis Bacon put it (in the *De principiis*), " Empedocles, Anaxagoras, Anaximenes, Anaximander, Heraclitus, and Democritus . . . set matter down as active, as having some form, as dispensing that form—and as having the principle of motion within itself." " Therefore," he adds, " all these as contrasted with Plato and Aristotle (*i.e.* Bacon's Aristotle), *submitted* their minds to the nature of things." That thus they " eliminated the supernatural " is true, true of all the Ionians ; true of Hippocrates when he denied that a particular disease was " divine " save in the sense that all things are divine (p. 80).[1] They saw in nature, one system, one source; not two. It was in the field of ethics, not of science, that the differentia lay between the Ionian, the Pythagorean, and the Platonic Schools.

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[1] Or at any rate the disciples of Heraclitus and Democritus and the Eleatics were so, in postulating one ground substance with its principle of motion. Some conceive this animation as inherent (" hylozoism " ; see Cic. *De N.D.* i. 10. 25) ; others, it is true, more or less as an influence from without, a divine spirit (Thales, Anaximenes). It must not be understood, because I am using certain Heraclitean ideas in connexion with those of the other Ionians, that he belonged to their school. Heraclitus, as I have said, was the first metaphysician, the first to set the microcosm before the macrocosm and, like Descartes, to find universals through the search into his own soul (ἐδιζησαμην ἐμεωυτον). Herein Socrates followed him (see Diels, *Heraclitus*, Book ii., ed. 1909 ; *Frag.* 16 ; see also *Fr.* 116). But these interpretations, tempting as they are, lie outside my subject.

But, as mere movement and change would realise nothing, was Time always "hurling its materials into nothingness"—"the busy dance of things that pass away"? surely not; the perpetual motion must be obeying, or have obeyed, some design. For Anaximander, and later for Anaxagoras (*Nous*), the force innate in elementary matter became something more; it became a shaping divinity under which all things, even the heavens, arose by "differentiation"[2] and unravelled themselves again indeed to destruction; but, matter and energy being replenished from an inexhaustible source—the infinite,[3] transmutations ever new and fresh were continually beginning again. Heraclitus, with whom then we take a new departure,[4] was perhaps the first to imagine fully the imperceptible molecular motion streaming through all the universe; the life even in the rocks; and facts, not as straws in the stream, but as eddies, gleams, or tints, in the flow. Fire (heat), by, or as, condensation and expansion of the particles of moisture, made the evolution of things by a kind of distributing necessity (*τινὰ εἱμαρμένην ἀνάγκην*). He seems also to have been the first to declare definitely the relativity of sense perceptions; their variation with the individual, and their instability as the foundations of truth. His contemporary, Xenophanes, said likewise (Frag. 14):

> *εἰ γὰρ καὶ τὰ μάλιστα τύχοι τετελεσμένον εἴπων*
> *αὐτὸς ὅμως οὐκ οἶδε· δόκος δ᾽ ἐπὶ πᾶσι τέτυκται.*
> (R. and P.)

"For if he were to speak truth, even to the uttermost, yet he himself doth not *know*: 'tis mere thinking that resteth upon all things."
(Tr. A. B. Cook.)

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[1] Cf. Cicero (*De nat. deor.* iii. 10): "Vide, quaeso, si omnes motus, omniaque quae certis temporibus ordinem suam conservant, divina dicimus," etc., etc.

[2] This word (*ἑτεροίωσις*) seems, no doubt, to have been used first by Diogenes of Apollonia (see p. 109; also Ritter and Preller, *Hist. Phil.* p. 126); but the idea was much earlier. It is to be found as noun, verb, and participle in Diels, *D.A. Fr.* 2.

[3] See *Parmenides*, p. 91.

[4] See *Heraclitus of Ephesus*, ed. Diels, Gk. and Germ. and Introduction, Berlin, 2nd ed., 1909; we are likewise in debt to Bywater's consummate edition of the text; Oxford, 1877. As Diels well says, Heraclitus is not obscure; the obscurity lies in the subject of his thought, in his height and breadth, not in crudeness or shortcoming. His style becomes clear as one studies it, in contrast with some superficially clear writings which become, as

Truth was to be attained by a supreme reason only (see *Frag.* iv., Bywater). In this conception of the relativity of sensory data Empedocles and Diocles followed him; and Protagoras developed it on well-known lines. The conception of Parmenides implied the absolute. For the Heraclitean, fixed categories are at an end; things, laws, customs, ideas, must all be continually undergoing change. By an extension of the condensation and rarefaction of Anaximenes Heraclitus taught that substances could be transformed one into the other, upwards and downwards—as air into fire, or water into earth. But the sum of being, primary or evolved, was invariable: *ἀπόλλυται μὲν οὐδὲν ἁπάντων χρημάτων οὐδὲ γίνεται, ὅτι μὴ καὶ πρόσθεν ἦν· συμμισγόμενα δὲ καὶ διακρινόμενα ἀλλιοῦται* ("For nothing of all things either perishes or is generated which was not in existence before; only by mixture and separation do they vary").

And here the following Fragment of Euripides may well find a place:

θνήσκει δ' οὐδὲν τῶν γιγνομένων,
διακρινόμενοι δ' ἄλλο πρὸς ἄλλον
μορφὴν ἑτέραν ἐπίδειξεν.

"Of the things which are nothing dies, but changing one with another they put on different forms."

By Anaxagoras *διακρίνεσθαι* and *συμμίσγεσθαι* were often used in opposition. Thus much of the Ionian philosophy was founded upon the "hylozoism," or animation of elementary substance; an immediate and original unity of matter and life (Ueberweg). Moreover, the Ionian sages perceived that motion, unless arrested, must be constant and persistent; a truth which, as even Aristotle failed to perceive it, fell out of sight until Galileo and Newton arose to restore it.

We now see more clearly how on this foundation of hylozoism Leucippus — a contemporary of Empedocles and Anaxagoras — and Democritus built that atomic idea which Benn used to declare to be the greatest contribution ever made to physical science by pure speculation. At that time of course it could not be worked out as a theory of motion,

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one digs below the surface, obscure. However in a certain mystic or transcendent—"divine"—quality Heraclitus and Anaximander came nearer than the other Ionians to South Italy and to Plato (see Zeller, and other well-known commentators).

massive or molecular; but may I illustrate by comparatively modern instances how this fundamental concept of molecular motion was lost and was found again. Gautier[1] has pointed out that it was one Jacques Rohault, a pupil of Descartes, who, in 1672, revived the traditions of this primitive (Heraclitean) element fire, or a source of fire, whose finest centrifugal particles filled celestial space, and traversed transparent bodies, occupying their pores (*vacua*).[2] Air, water, and solid bodies were, for him likewise, all mutually convertible; one substance. A *locus classicus* in the history of heat as molecular motion, and in the foreshadowing of the mechanical equivalent of heat, is of course the passage in the *Novum Organon* (in Fowler's edn., pp. 368-70), which however, as I read it, scarcely sustains all the liberality of interpretation which has been given to it; for instance, Bacon still regarded cold as an entity;[3] Rohault was more definite, and so, another half century later, was Boyle,[4] who clearly conceived heat to be an intimate vibration of particles; a hypothesis which he illustrated by the heat manifested as a nail is being hammered into a block of wood.

In respect of metabolism Heraclitus conceived "the way upward and downward" (*ὁδὸς ἄνω καὶ κάτω . . . παλίντροπος ἁρμονίη κόσμου . . . γίνεσθαι πάντα κατ᾽ ἐναντιότητα* (*ἐναντιοδρομία*), "recovering the consumed"—as integral; not moving, as according to Empedocles and others, in alternate periods of construction and demolition.[5] In like manner Heraclitus imagined a kind of cosmic metabolism or anathumiasis, between earth and sea; connecting the evaporation with return as rain, an observation more fully taught in the *Airs, Waters, and Places* of Hippocrates. Thus Heraclitus attained to a clearer idea of the interplay of opposite motions or qualities, regarding them not as acting alternately, nor as the mere balance of strife—the mean (*μεσότης*) of Pythagoras in arithmetic, or harmony of temperament in music—but as conditioning each other reciprocally within the process. Well has it been said that Pythagoras and Heraclitus both drank of the golden cup of Apolline wisdom. Rest or immobility therefore for him meant sleep and death ; strife was life : while the government of all things was *logos*, or law in our sense of natural order.[1]

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[1] Gautier, *Rev. gén. des sciences*, mars 15, 1915.

[2] Rohault's work was entitled *Traité de physique*, Paris, 1671. Harvey, as we shall see, never really tackled the sources of motion as the ancients did. He was content to refer the motion of the heart substantially to Aristotle's quintessence.

[3] Aristotle had suggested that the light and heat of the celestial bodies might be due to the friction of the air as they sped through it, a brilliant notion for that age (*ἡ δὲ θερμότης ἀπ᾽ αὐτῶν (τῶν ἄστρων) καὶ τὸ φῶς γίνεται παρεκτριβόμενον τοῦ ἀέρος ὑπὸ τῆς ἐκείνων φορᾶς, De caelo*, ii. 7).

[4] R. Boyle, on the *Mechanical Origin of Cold and Heat*, 1744. The dynamical theory of heat was formulated in scientific terms by Carnot in 1824 and verified by Joule in 1840, 1848, etc.

[5] Though no doubt Empedocles could not but have apprehended, indeed he implied, consentaneous action.

Aristotle (*De an.* i.) in harmony accepted the crasis of opposites (pp. 100, 101), *e.g.* that the animal body is compacted (*συγκεῖσθαι*) of opposites (*De mund.* v. 396 b 7, and *Eth. Nic.* ii. 1155 b 4). The ancient philosophers conceived of opposites as in strife, or as reaching a concord by interaction and symmetry, in distinction from the schools which regarded evolution as the action of *similia similibus* ; in this case they held that there could be no grip, no *engrenage* (see p. 129). However we must discriminate between the function of *similia similibus* as a process of evolution or change, and as giving a sense of pleasure, going sweetly ; as in Theophrastus (*De sensibus*, 9) "*ἥδεσθαι δὲ τοῖς ὁμοίοις*," etc. As a monist Heraclitus was opposed, as I may remind you again, by Anaxagoras, who, from observation of man as microcosm, assumed "active *Nous*"—a fluid, the thinnest of all things—to be independent of matter, pre-existent, creative and directive (p. 120) ; and later also by Aristotle.

As to the atoms, Aristotle argued besides that Heraclitus, in assuming a parallel rain of them, made no allowances for atmospheric resistance. Indeed, as I have said, in those earlier Ionian days air was scarcely realised as a material thing, though even Thales and Anaximander had demonstrated that air was a substance. Furthermore, as this rain of atoms fell at equal rates, without the deflections and collisions afterwards assumed, vortices of condensation and construction would not occur. Nevertheless it is to the credit of Epicurus that he had insight enough to accept a fruitful working hypothesis which Plato and Aristotle ignored, or indeed rejected. Remote in time as these considerations are, I repeat we shall find that without them the doctrines of the Greek physicians in Rome, of the Methodists and Pneumatists for example, cannot be comprehended. Here I may recall and contrast the opposite static conceptions of the Eleatics, whose cosmic theory, being largely a specious verbal dialectic (an illusion of language, or logical puzzle, like that of Achilles and the tortoise), it is not easy for us to seize; it implied, as they themselves taught explicitly, that as a thing is or is not, there could be no becoming (*ἀδύνατόν φησιν εἶναι εἴ τί ἐστι γενέσθαι*); that matter was a uniform, immovable, eternal whole—a continuum; that it was therefore intimately continuous, containing no vacua—no pores: a corollary in which Aristotle seems to have agreed with them; and that indeed a void, being nothing, could not exist: I recall this fundamental notion because, as I have said, we shall have to consider it in practice in our appreciation of the Methodist medicine in Rome. Suffice it for the moment to repeat that from the Eleatic point of view there could be no molecular motion. Lucretius affirms (*D.R.N.* i. 334-6)—where no vacuity there no movement. Before Parmenides it was *rest* which had no explanation. Moreover I repeat also that the concept of the absolute thus returned, against that of relativity which was involved in the Heraclitean flux (p. 114). The original Parmenidean qualities were only two—cold and heat: that is, of the elements fire (or sky) and earth (*θερμὸν καὶ ψυχρόν, οἷον πῦρ καὶ γῆν λέγων*, R. and P.). Heat was pre-existent, and the cause of motion.[1] The ascendancy of Parmenides lay mainly in his ethical enthusiasm, in which he resembled Pythagoras.

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[1] Logos meant more than this, a creative operation ; an idea which passed on to Philo and the author of the Gospel of St. John.

It is difficult in a few pages to describe the course of these physical ideas of the ancients: not only because of the intricacy of the subject but also, as we shall see again and again, because their logical terms were unfixed in meaning, even in the usage of each individual philosopher; the ancient thinkers being by no means always consistent with themselves even in doctrine. Aristotle, if consistent in phrase, vacillated at times both in meaning and in terms.

In passing on from the pre-Socratic to the Aristotelian period, and to *Anaxagoras*, the master of Pericles; this philosopher, as I have just said, definitely found the principle of motion in *Nous*, a formative spirit; and thus made the first definite distinction between soul and body.[1]

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[1] Telesius (*De nat. rerum*) revived the Parmenidean philosophy in the sixteenth century.

We have seen that the greater Greek philosophers taught that all activity, force, and intelligence were derived from soul or mind, whether implicit or implanted; or that mind, by some of them more or less identified with heat, and a source of power as well as an organ of perception and conception, was the active quality in every and all bodies in the universe. But the *Nous* of Anaxagoras was not the transcendent Aristotelian Active Reason; nor again mere intellect,[2] for it contained psyche. *Nous* was an "entity"; to make use of Maxwell's phrase, a kind of "sorting demon,"[3] but one which knew as well as governed and ordered.[4] For Aristotle *Nous* was the faculty whereby we proceed from data of sense (προγιγνωσκόμενα) to universals. But, like Fr. Bacon, he was disposed, in those simpler times very pardonably, to underrate the number of instances (facts) required for review (ἐπαγωγή). Thus it was that Anaxagoras deserted the Ionian monistic idea of intrinsic evolution and became a "dualist." It is interesting to find Prof. Dendy saying to-day, though not as a dualist: "I agree with Jennings that we cannot make a distinction between the higher and lower organisms in this respect, and that all purposive reactions or adjustments are essentially intelligent."[5] But *Nous*, for example, might set up, or primarily consist in, a rotatory motion which, by promoting aggregations, might awaken in chaos the evolution of order and form; a fine conception. Otherwise, like Diogenes of Apollonia, Anaxagoras was something of a reactionary—as towards Empedocles. The prime mover Anaxagoras also conceived as itself unmoved (p. 113), a notion to which we may find a superficial analogy in the loadstone; the prime motor created movement, and dominated the world, without taking part in it, *e.g.* the author of the *Περὶ πνεύματος*, who puts it aphoristically "*Ἅπαν γὰρ τὸ κινούμενον ἐξ ἠρεμοῦντος κτλ.*" By a metaphysical refinement fulcrum became the immovable principle; and movement arose only under the impulse of unrealised desire (*ἔρως* or *ὄρεξις*). Some philosophers of Aristotle's age fancifully regarded the spinal marrow as thus originating motion, itself unmoved (*ἐνέργεια ἀκινησίας*); and so compared it with the axis of the earth. Like nearly all these philosophers Anaxagoras studied anatomy, and is said indeed to have been the discoverer of the lateral ventricles of the brain.

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[1] Anaxagoras was strictly pre-Socratic; during the youth of Socrates he left Athens for Lampsacus (see A. E. Taylor, *Cl. Qy.* xi. 81.)

[2] It was in later times that *Nous* became restricted to the ratiocinative or intellectual faculties of man (διανοία or ψυχὴ διανοητική); Darwin and others restored some of its earlier meaning, and attributed it to animals. But for the Ionians it meant something less critical; something more creative and vital. Socrates, who was for a while a pupil of Anaxagoras, and was delighted with the first idea of *Nous*, yet was disappointed by some inconsistency in his teacher's use of the term.

[3] Thales had suggested sorting demons but as a many—a polydaemondom.

[4] Cf. Aristotle's ἡ γὰρ φύσις δαιμονία ἀλλ' οὐ θεῖα; which however is not obviously consistent with his attribution, after Hippocrates, of divinity to all natural things; natural and supernatural being regarded as one.

[5] *Nature*, Sept. 3, 1914, p. 24. See also present writer's Address to Br. Med. Assoc. at Cambridge, *Br. Med. Journ.* July 3, 1920, p. 4.

Aristotle, who is regarded as the first thinker to base a science of astronomy on mechanics, in one respect falling short of some of his predecessors, supposed, as I have said, that bodies ordinarily moving in void, unless impelled by some incident force, would stop. So, besides the heavy bodies which flew down and the light bodies which flew up, he conceived a fifth element which was eternal and infinite, and had generated the "most perfect and perpetual"—*i.e.* circular—motion; the orbits, as he supposed, of the stars. Hence in Harvey's view was derived the motion of the heart. The heavenly bodies, carried in their transparent spheres, were moulded out of this essence. But even behind this, or in the centre of the wheel, there must have been a power animating the whole Cosmos, a prime mover—an "unmoved mover"; so far as man is concerned the human soul; so far as the Cosmos is concerned God, whose emanations were the functions of nature. For Aristotle God was not the great spirit of pantheism but "pure form"; the one self-sufficing, individual, generative, self-conscious but wholly self-contemplating and therefore non-interfering being.[1] But the positive and analytic genius of Aristotle was incongruous, or at any rate unassociated, with the imaginative compass of an Anaximander or a Heraclitus. For him the atomic theory, being beyond formal proof, had no attraction; he also denied, or rather ignored, inter-atomic pores, or spaces anywhere. In one principal respect indeed we find the problem of motion radically altered by Aristotle himself, and, as Benn pointed out, misconceived; a misconception due to his desire to give living motion a priority over mechanical, reason the priority over life. Aesthesis and kinesis were functions of the "animal soul," and formed the "dynamic bond" (ἔργα κοινά), between it and the body.[1] Motion, he said (in the *Metaphysics*), arose from a *logos*, or active idea, of the end (final cause) which excited a desire or determination of the Will (προαίρεσις), seated in the heart, which incited to action, to motion resulting from sensation; an opinion which arose from his contemplation of the *punctum saliens*. The foreknowledge was however of the essence of the activity (Stocks). Efficient and material causes only he assigned to physics; the formal and final he reserved for a transcendent logic (metaphysics). Thus, in his general view of kinetics, Aristotle was led to put animal motion of translation (φορά) as primary, and intimate motion, as of molecular particles (ἀλλοίωσις), as secondary; perplexing himself; for he said also that "as a small rudder turns a big ship so a minute central molecular change may make an enormous change at the circumference."

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[1] At this point, for instance in the distinction between God and the outer sphere of heaven as prime mover, Aristotle is not quite consistent. But we may say in short that he contested the Platonic doctrine that the soul moves itself, or can move; for the soul, like all other things, derived its motion from a first—primary—mover itself unmoved (see *De an.* i. 2). But the soul is capable of motion of translation (*φορά*), change (*ἀλλοίωσις*), waxing and waning (*αὔξησις* and *φθίσις*); all in spatial seat (*ἐν τόπῳ*). If the soul has these properties by nature (*φύσει*), not by contingence only (*κατὰ συμβεβηκός*), she is herself spatial. But, later, as I am informed, Plotinus argued that the thinking soul had no movement in space; it rested in its own being, with the movement only of its own peculiar life. Above it he placed the highest reason (*νοερὰ ψυχή*) by which we are ennobled. If to-day these speculations seem vain, the reader must understand that without some description of them the history of science, and in particular of the idea of the origin of motion, Harvey's conceptions for instance, cannot be apprehended.

Yet Aristotle was perhaps the first philosopher to place the soul in some such transcendent light as that in which we regard it, and by his treatise Περὶ ψυχῆς to provide the battle-ground of the medieval commentators, especially of Averroes and St. Thomas; and from this transcendent soul he distinguished the psyche which he brought into physics, analysed as a property of matter, and gave as the foundation of modern psychology.

Thus we find how very gradually and periodically the conception of motion was completed. Even we now cannot imagine *whence*, we have given it up; the *how* only can be known. Galileo thought the first impulse to the planets was used in projecting them towards the circular orbit which, once attained, needed no derivation; circular motion being for him, as for Aristotle, eternal, regular, uniform, natural, perfect, and inexhaustible; rectilinear motion being on the contrary limited and temporary;[1] thus it was that terrestrial bodies without the superadded agency (entity) tended to come to rest. Even by Galileo, the founder of dynamics, the combination of centripetal and tangential force was not perceived.

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[1] See Introd. *Parva nat.* (κοινὰ σώματος καὶ ψυχῆς ἔργα).

Aristotle, in his endeavour to account for perpetuity of motion and the transformation of potential into actual being, distinguished between generating causes and conditions of stability (*De mot. an.*, etc.). For the inner movements of growth and decay, whether in animals or plants, he found sufficient reason in the nutritive faculty; but he argued that nutrition did not suffice for locomotion, or plants would walk, developing limbs for the purpose; an argument, as in Aristotle always, forcible, if to us not always convincing. If the contributions of Aristotle to the theory of motion are a very interesting subject of inquiry, for by Aristotle Harvey was deeply influenced (p. 239), we must still bear in mind that his greatness was not as a physicist; we should say indeed, with all respect, that he used the ordinary physics of his time in no very distinguished way: it was in Natural History, and in social and ethical thought, that his scientific work was immortal; this training of his mind to observation it was which at a later date gave such power to his conceptions of ethics and politics—studies which, whatever their transcendental scope and complexity, pertain nevertheless to the realm and kind of biology.[2] Professor D'Arcy Thompson says that Aristotle first used the metaphor, or formed the concept, of the "social organism." . . . "He was the great vitalist, the student of the body with the life thereof, and the historian of the soul," for he declared the continuity of structure (*συνέχεια*) from plant to animal and from animal to man; soul (*ψυχή*)—the vital principle—being not a guest but a function.

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[1] Francis Bacon (*De principiis*) quoted Telesius as regarding circular motion as "interminable and for its own sake," and therefore the motion of the heavens; whereas motion on a straight line is to an end—for the sake of something else. But true as was Bacon's notion of heat (in the well-known passages of the *N.O.*—twentieth Aphorism) as an expansive motion in the ultimate particles of matter, yet he also shared the opinion of Telesius; as, to wit, many sentences of the *N.O.*, *e.g.* ii. 48. 17 "per circulum, motu scilicet aeterno et infinito." Mussenbroek regarded motion and rest as two attributes or properties of terrestrial bodies. Even Kepler was not bold enough to merge celestial in terrestrial mechanics; this was really left for Newton. Yet on the other hand Aristotle did attempt to describe meteorology on positive lines.

[2] *E.g.* his laborious collection of two hundred or more *πολιτεῖαι* or actual political constitutions.

If we look back from this point we shall see that the ancient natural philosophers regarded primitive substances in three several views or schools. Empedocles conceived them as qualitatively distinct, limited in number but infinitely divisible: Leucippus, as in quality homogeneous and indivisible, but in number unlimited, and he placed them in empty space or spaces: Anaxagoras accepted the unlimited number, but, as regarded homogeneity, heterogeneity, and divisibility, returned to the ideas of Empedocles.

Now are we to call these great Ionians by the vague name of cosmologists? Sages shall we not rather call them—"wise men," as they were to our forefathers? It has been well said that with the Ionians new ideas swam into consciousness like new stars; not only so but, as Diels (*W. u. T. loc. cit.*) points out, the fertile principle of wedding theory to practice was taught and developed by the Ionians. This integration he illustrates by the great technical works in Samos, and the exquisite mathematical proportions of the renowned Hera Temple; and again by the great aqueduct of Eupalinus with its kilometre tunnel (Herod. iii. 60) bored from both ends, presumably with fair accuracy; no light calculation to-day. The instruments and methods for these achievements must have been of no little refinement. Miletus seems to have been the chief source of these developments. But the sages were more than this, more than scientific seers and great inventors: they were the first men to sing the new song, the song of man's inheritance; they awoke to the sense of his spiritual endowment, of his unconquerable mind; to the sense of his part in the universe; no more as a passive limb of it, no more as making only a living out of it, but as measuring it, comprehending it, and making its body and spirit his own. Theirs then was the rapture of the first revelation, that of this manifold beautiful and growing world man might win the secret and, with the image of God, inherit also a share of his creative spirit. Thus they were not, or not only, analytic but also constructive thinkers; in their day indeed analysis was hardly possible. They foresaw the full meaning of their search, and its end; how the world should be known through the ψυχῆς λόγος—the mind and soul of man, itself a stream of the eternal wisdom (ἓν τὸ σοφόν). In the words of Heraclitus "It is the part of all men to know themselves and so to have understanding" (*ἀνθρώποισι πᾶσι μέτεστι γινώσκειν ἑωυτοὺς καὶ φρονεῖν*).[1] We must not take these first elements, such as air, water, earth; or again the almost mystical ideas of breath, pneuma, fire, seed and germ, too identically, too materially; but imagine them as emerging from legend and symbol, as signifying phases of birth and growth, of infinite hope and potency. Thus when we read the proclamation of Anaxagoras that Reason is the first cause of all things, we shall not be content to take the words as a mere philosophic ingenuity, nor as the terms of a neat analysis; we shall try to enter into the splendour of that new Ionian imagination, into their glory in the dawn of the realm of reason; into their possession not only of the sublime order, not only of the conversion of agglomerate, disorderly heaps of phenomena into a unified orderly whole, not only of the conception of "Nature" as including both living and unliving, but also of the consciousness that—What I can begin to comprehend and to interpret must be of me, and I of it; I must be one with its life and purpose; I too a creator.

It is not fair to call these Ionian speculations "shots in the dark," as says Sextus Empiricus (*περὶ ἀδήλων ζητοῦντες τοῖς ἐν σκότῳ ἐπί τινα σκόπον τοξεύουσιν*). There are two kinds of the inscrutable; that within the compass of human faculties and that beyond it. We, who are now learning this difference slowly, must remember that to the Greeks it could not have defined itself; and if among the undisciplined followers of these sages speculation unbridled by experiment ran wild, if it bred swarms of childish, ineffectual, and wearisome conceits, vanities in our soberer times not unknown, yet these were but the waste of a stupendous factory of ideas which impregnated and even built up the mind of all later generations. Of such men first the Coan and Cnidian schools were made; then the schools of Alexandria: and upon these was founded medicine in Rome. Even to-day it is startling to feel how near us these great thinkers are still, how much nearer than Abélard and Aquinas, when they unfurl the canopy of heaven into the aether of infinity; when they prophesy of celestial and terrestrial physics, of natural law, of evolution from rudiments, of atomic constitution; of indestructible matter and force, of attraction and repulsion, of condensation and attenuation, of molecular energy, of development of form and quality by combination of atoms in definite proportions, of formative combustion, and even of "mind-stuff." By their occupation in these great matters, in the cosmic compass of their thought, the expression of it attained a breadth and elevation which are rare in the writings of those concerned with narrower fields of observation. "The pursuit of knowledge and wisdom was to them a joy above measure." In the words of Solon "they would fain grow old learning many things." Unhappily, in the tragedy of nations Ionia perished, as an idealist people, in the luxury and decadence of its great cities, under the blight of that political freedom in which, and in which only, the higher life of the human soul can grow.

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[1] (See Diels, *Herakleitos v. E.*, 2nd ed., Berlin, 1909.) Diels traces these doctrines in later Hippocratic and other writers in a very interesting way (No. 116, p. 44, Bywater, No. 106). In an interesting passage he considers the lofty, intense, and concentrated style of Heraclitus; Delphic, Aeschylean, and Pindaric, in character; and regards him as the founder of gnomic, aphorismal form. This form was continued in some of the Hippocratic treatises as in the *Aphorisms* themselves, and again in the *De victu*. I may instance the well-known first Aphorism as in its condensed wisdom almost unique. We may go further and speak of it as the earliest prose. This form may have been adopted, as verse forms were adopted, to be memorable, and to be carried over great distances. Thus, says Diels, certain aphorisms were carried over seas to Elea (Parmenides) in the course of some ten to twenty years.

Now it was of such a stem and nurtured in such ideas that the Hippocratic physicians of the fifth and fourth and later centuries arose, and again those of the Alexandrian schools. Of these and their successors many found their adventurous way into Rome; most of them being also of Ionian stock (p. 84). If the immigrants were by no means always the chosen spirits of their race, still in mind they were born free, released from hieratic and magical traditions, and nursed in conversation with scientific reason.

In summary; if we are fully to realise the historical values of the Ionian elements in the various sects of Medicine in Alexandria and Rome we must look not at motion alone, nor at pneuma alone; not at atomism alone, nor at combustion or heat alone: we must make some synthesis of these conceptions. With them we must conceive of an ethereal substance penetrating pores between the atoms of matter, a substance in incessant molecular activity, and either a mode or a source of heat; an air which, in its finest particles, is of the nature of fire. Thus early was the key to living processes perceived to be a mode of combustion. Notwithstanding, in that period of thought, the Greeks could not get rid of the tradition which referred each and every mode of activity, such as weight, levity,[1] heat, cold, the several souls, and so forth, each to a particular entity; yet, I repeat, as we ourselves have scarcely got rid of this habit of thought and speak still of an electric fluid, and in the medical journals of our day frequently find this disease or that spoken of roundly as a "morbid entity," it is not for us to cast stones at our forefathers for this mode of conception, but rather to recognise that, even by the standards of to-day, the Ionian synthesis was in attitude good physical physiology.

Furthermore, in these various motions and atoms, were not the discovery and demonstration by Pythagoras and Archytas of rhythm, of acoustical figure, of musical numbers, wonderful in idea, in insight and in experimental achievement: wonderful, that in these myriad and multifarious swarmings and pulsations of particles of matter was found a native and intrinsic quality of order and law, of self-determination, of harmonious building, growth, and development? And, again, that in the same school this shaping quality was supposed to depend upon the proportions and polarities of atoms in their combinations; proportions of endless permutation; combinations naturally so pregnant and creative as ultimately to unfold even psychical functions, and to rise and develop from "besouled elements" to an organism in which the words pneuma, soul, celestial motion, divinity, became really so interfused, so continuous one with another, that laborious categories of precision were drawn out into logical devices. In so far as soul became for Aristotle "form" it became a primary quality of nature; and therefore, unlike the active and superlunary *Nous*, or the Unmoved Mover, a proper subject for physiology and physics.

And do we not thus begin to apprehend the meaning of "form," that perplexing, intangible idea which Aristotle made familiar to later generations, but failed to define; and which to us smaller folk has always been no less elusive; as it were another phantom of logic? If we grant that "form" was but a logical device, the notion must yet have had its causes: what was it herein that the ancient and medieval philosophers were trying to get at? To me it appears that by "form" the peripatetic meant not so much completion, or realised purpose, or a reflected call of the end, as this innate self-building and ordering faculty which Pythagoras called, not very happily, "the Limit," (p. 97) and we, not much more happily, "Law." The "limit," if we dwell upon it, implies no doubt, in this context, delineation, shaping, character; yet even so the term is too negative; something is wanted more figurative, more lively. What Aristotle and his predecessors saw was, that matter is not a passive substance receiving form from without, as wax is formed by a seal—the idea of the book of Genesis;[1] by "form" they apprehended a certain inward unity and direction of function and so of structure; the dynamic effects of atoms and molecules by their orders (p. 102). As we are proving to-day, all phenomena can be, must be, expressed in terms of energy (dynamics): the notions of independent "matter," and "materialism," are extinct.

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[1] For instance, in the MS. "Anon. London" it is said that decrease of weight did not necessarily imply loss of substance, as the addition of air or spirit would make a body lighter. Plato however did attain to a perception of relativity in this respect; by his original genius he perceived that heavy and light were not such *per se*.

From this point of view "form" appears as the structural aspect or diagram of function; and "entelechy" as the consummating of functions and organs in a complete individual. In this conception we have by our imagination to blend potentiality and realisation, the pregnancy of each phase or stage of making with unexhausted formative capacity. It is on the turn of the tide, as dissolution prevails, that "form" melts away. This spontaneity of innate form, the potential of the inherent properties of atoms (Democritus), as contrasted with the creative activity upon it of an external agent, is essential to the Ionian and even to the Aristotelian idea—and, may we not add, to the "idea" of Plato; yet even Aristotle did not conceive of matter and energy as one, with the vividness of the earlier Ionians. It is the lack of a perception of this dynamic and creative quality, and the current static notion of force acting upon passive matter, or of a mould impressed upon substance, which in other schools has darkened the right interpretation of "form"; and, what is far worse, cloyed the mobile apprehension necessary to the idea. Far from "materialism"; in this Ionian conception "matter" becomes a mere logical residuum. For Ionia there was no passive substance driven by currents of force, nor again animated or deflected by supernatural contingencies; nor was there any teleological beckon, but a manifold evolution of a universal energy, or divine spirit, in all things. For example, Democritus made the curious reflection, that there must be much reason and soul in the air, or we could not assimilate them by the breath (see Arist. *De resp.*). The stigma of materialism may indeed have originated in the doctrine of certain philosophers that if soul can act upon body or substance, or co-operate with it in unity, it must in its primary elements be akin to body; for, if not, where or how could there be a *point de prise*, a grip? As Empedocles said truly, to be in touch with matter, spirit must be akin to it, or have some substance in common; Heraclitus made the same reflection; but to the thorough monist matter and spirit were but different aspects of the same substance (φύσις ὑποκειμένη). And the difficulty was not got over by the well-known division of the soul into kinds.

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[1] Here Zeno also was in error; he supposed that the soul received impressions (φαντασίαι) as wax receives that of a seal.

These reflections are too important for later biological history, and too congruous with modern philosophical thought, to need apology here. Albeit, as Aristotle said, by being arising out of countless combinations of atoms heredity was not explained. This riddle we must leave to the modern student of the chromasomes.

IV. Aristotle and Alexandria

After the Ionian sages, and before the rise of the Alexandrian schools, in himself a period, arose Aristotle; by far the greatest scientific genius this world has produced. Even yet we are hardly able to grasp the full conception of his achievements. Certainly no view of his work in biology, however sketchy, is possible in this place. In the field of science he may be regarded as the first naturalist or philosopher to have built upon a foundation of facts of observation, and to have declared that anatomy must be the basis of all biological theory. It is true that the Hippocratic physicians accumulated remarkable series of facts, most successfully on the side of surgery; but their work was not, as that of Aristotle, for disinterested science but for immediate practical ends. Besides his observations, Aristotle made occasional experiments; for instance, on the alleged immunity given by marjoram to tortoises which thereby were enabled to eat snakes with impunity; but he did not conceive, nor systematically practise the experimental method. The Alexandrians and Galen made some not inconsiderable advances towards this method; but to set forth the experimental method of natural research systematically, and in the full light, was left for Roger Bacon and Leonardo. Nevertheless Aristotle made prodigious advances in anatomy and physiology, advances which gave to Alexandria its example and departure; and he formulated the study of comparative biology, and thus of methods of comparison, and of history. He taught men not to recoil from examination of the humblest animal, for all are marvellous and reveal the order of nature. So far as I have referred, and shall have in the course of the following pages to refer to his discoveries it can be only incidentally. For medicine Aristotle is no outstanding person; his one work on a medical subject is wholly lost. Still in the history of science he stands out as so ascendant, so monumental a figure that we are hardly able to discuss any period of ancient science or ethics without regarding him.

CHAPTER V

ALEXANDRIAN MEDICINE

In this lecture, if I am to trace the sources of traditional Greek Medicine, and to follow the currents of its history as it flowed into Rome, I must venture upon another digression; I must give some sketch of the universities of Greek civilisation, particularly of the University of Alexandria.[1] For example, Asclepiades, Dioscorides, Soranus, Rufus, Galen, Paul of Aegina, were all students of Alexandria. In the three centuries divided midway by our era many great universities and schools flourished in the light of the Greek radiancy: Pergamon, with its salaried professors and great library, most nearly perhaps the rival of Alexandria; Antioch, Cos, Rhodes—always a sound, steady school, one on whose desks Cicero, Mark Antony, Julius Caesar, Brutus, and Cassius, *plagoso Orbilio*, may have carved their names; Berytus—a long celebrated school of Law, the Bologna of the East; Tarsus—a considerable school but chiefly perhaps for natives; Nicaea; Nicomedia; and, in the West, Marseilles—Agricola was an old Massaliot—the mother of some other schools in Gaul. The flourishing period of Athens as a university, brilliant as it was for a while before and after our era, was somewhat later than the bloom of Alexandria. In still later times, in spite of edict after edict, Athens degenerated into the bombinations *in vacuo* of noisy rhetoricians, and became the arena of gladiatorial dialectics. Notwithstanding, the ruthless suppression of it by Justinian in A.D. 529 not only quenched the torch of Athens, but stamped out also other nurseries of learning in

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[1] Here I am indebted to Susemihl, *Gesch. d. alt. Lit.*, Leipzig, 1891, a scholar who perceived that from a history of culture medicine could not be omitted; and to *Universities in Ancient Greece*, J. W. H. Walden, 1912. By "university" I mean here any considerable and abiding seat of general studies.

East and West, so that amid the gloom and devastations of the "Dark Ages" no star shed even a puny glow.

The school of Alexandria came to an end, in its iatrosophistical phase, on the destruction of the city by the Arabs in 640 A.D. With the Arabs then began, as with them ended, the Middle Ages.

The Alexandrian Museum, created by the First and Second Ptolemies, was a royal foundation, and was established in cloisters adjoining the palace. In many ways, as in its common hall, it resembled a modern university. The professors and teachers had liberal salaries. Its library, founded perhaps on that of Aristotle, is unforgotten; it contained, according to Tzetzes, about 50,000 rolls. Like the famous library of St. Hilary of Poitiers—rich in precious manuscripts, and that of Louvain, it was destroyed by barbarians. Such was the breadth and power of the Greek language and genius over East and West, that, then as in the Middle Ages, students from all parts, and of all nations, crowded to read the books, and to hear illustrious masters; masters not sophists only but also, in Alexandria, imperishable investigators in almost all branches of science. The library in the temple of Serapis was founded later; and later still a Jewish, and also a Christian College. The greek language was in Eastern Europe as latin became in the West, an enfranchisement, a bond of letters, a separation from barbarians; and in such scraps of biography as remain to us we observe how frequently the relation of master and pupil is recorded.

In Alexandria arose the great school of medicine which produced Herophilus and Erasistratus; names to us almost mythical, so illustrious was their fame, so little are they known to us now. At the time of the foundation of the school of Alexandria the tradition of Hippocrates was probably in full vigour, as for instance in Athens also under Diocles; a tradition however not so much of formal doctrine as of observation, comparison, and suspension of judgement. For although it is true that the humoral doctrines were held speculatively, yet the observant reader will perceive in the best Hippocratean treatises how little of the clinics and therapeutics was derived from *a priori* applications of them. This pedantry grew up with the Galenists. But from this positive medicine, as from the history of religions, we have seen how under the later Alexandrian mixture of Greek and Oriental tendencies—especially of platonist and pythagorean ideas—certain notions in medicine, the humoral doctrines especially, crystallised out in rigid forms; and how principles, and even words, becoming detached as abstract dogmas and terms, gained acceptance as entities or as forces. We have seen also that these later traditional teachers became known as *λογικοί—dogmatici*: moreover medicine became more and more deeply interfused with philosophy; and probably the *Timaeus*—as Hauréau said, a bad training ground for ignorant men—began to impose itself upon physiology, as it did in the Middle Ages. To these tendencies, as commerce increased, were added from the Orient other influences also, of still worse consequence; motley mysticisms and occultisms, emanations, astrology, and the whole apparatus of demonology. From Pharaonic Egypt medicine probably received little, for good or harm, unless it were an accumulation of drugs; under the Pharaohs medicine was arid and sterile, for the anatomy of the embalmers was as rudimentary and pettifogging as a quartermaster's astronomy. Nevertheless it is supposed that the doctrine of the four humours was carried from Egypt to Ionia, which had active trade relations with Egypt. The humours were attached afterwards to the four Sicilian elements and their qualities: sanguis aerem, cholera ignem, melancholia terram, phlegma aquam, etc. And it must be admitted that the ancient Egyptians derived some rude anatomy from the embalmers, and still better, as Hyrtl says in his well-known *Dissertation*, from those of the period when it was customary to remove the flesh from the bones. Thus some hints of anatomy may have reached, probably did reach, the Sicilians, Diocles, and even the Alexandrians.

The hollowness of the "Dogmatic," as was natural, resulted in the empirical reaction of which I shall speak presently. But let us turn now to the Greek tradition, not purely Hippocratean but, generally speaking, almost free from sacerdotalism, on which the later Greek medicine was nurtured.

The formal attempt to contrast the schools of Cos and Cnidus, and to allot to each its several system of argument and practice, fluctuating, as such doctrines must, with the views of the more eminent leaders, was perhaps never a very successful inquiry; and, in the absence of almost all considerable documentary data, is, in the opinion of Haeser, impracticable. The authenticity of the works attributed to Hippocrates had already become a problem for the scholars of Alexandria, as again it was for Galen and his times. In our day the search for Hippocrates has been compared with the search for Homer. "A great name," says v. Wilamowitz, "without any background of writing (*Schrift*)." As of Socrates and of certain other great examples, so it may have been of Hippocrates, that his marvellous ascendancy came about rather by personal than by literary influence. All we can safely assume is that on the whole the Coans were disposed to have regard rather to the general state of the patient, the equipoise of his functions, and the external conditions such as climate; whereas the Cnidians were disposed to give more attention to the organ affected, and so to rely more on local than on constitutional means of cure. In our own terms we should say that the Cnidian would have discouraged general pathology; and that in prognosis and therapeutics reliance on the whole man, on the *vis medicatrix Naturae* (*νούσων φύσις ἰατρός*), was a Coan point of view. Asclepiades, instructed in the physics of Alexandria, cannot but have recognised the tendency of moving systems to regain equilibrium; and from his practice it is evident that he protested, not against this beneficent bias, but against a teleological way of putting it. Indeed for Aristotle himself, in distinction from Galen, it is no less just to admit that "teleology" may have meant no more than an analysis of statical relations; that the bodily functions knew no end outside themselves.

From allusions in Aretaeus, Galen, Caelius Aurelianus, and other authors, we apprehend that at the time of the rise of the school of Alexandria both these earlier schools, Coan and Cnidian, were in activity. In nearer proximity were the important schools of Magna Graecia and Sicily, of the disciples of Pythagoras and Empedocles. Herodotus speaks of Cyrene and Rhodes as the two great medical schools of his time. The son-in-law of Hippocrates, Polybus, in magnanimity, sagacity, and experience worthy of his noble kinsman, had carried forward the Coan school; if, according to Galen, with too loyal an adherence to all its precepts, yet with signal success. Diels has pointed out passages of Plato and Xenophon derived from Polybus. We cannot suppose that so eminent a physician as *Diocles* (*c.* 350

B.C., or a little earlier), the last of the Hippocrateans proper, though resident at Athens and so, it is said, the first physician to write in Attic greek, could have been without considerable influence on the rising Alexandrian school.[1] Diocles was too wise and too experienced a man to be a partisan; yet as a platonist, his influence may have helped towards this bias in Alexandria; he may have sent thither a copy of the *Timaeus*! Praxagoras of Cos, a pupil of Diocles, the first physician to teach the value of the pulse, as in fever, if not to discover it (p. 301), was the master of Herophilus, who again, and whose scholars, were accordingly, with more or less truth, regarded as, in habit of mind, Coan. Chrysippus however, the master, through Metrodorus, of Erasistratus (p. 138), was a Cnidian; and he and his scholars were reckoned rather on the side of the tradition of Cnidus.[2] He also knew the acceleration of the pulse in fever, though Herophilus seems to have been the first to count it. It is probable that the inclination to anatomy was carried into Alexandria by the influence of Diocles, Praxagoras, and Chrysippus—by Chrysippus probably under the influence of the scientific Eudemus.

Diocles was moreover a disciple of that Philistion of the Italo-Greek Locroi, a Greek colony south of that of Croton, of whom I have spoken already (p. 84), and carried thence to Alexandria the idea of the hegemony of the brain (p. 147), the subject of the later researches of Herophilus. As Diocles was also a disciple of the Hippocrateans, especially, as Wellmann points out, in the doctrine that the nature of the human body cannot be understood without consideration of its milieu—of climate, season, habits, meteorology, and so forth—Diocles, who as I have just said wrote in Attic, is a central figure for the doxographist. Galen testifies that he was a high-minded man, animated by a love of his kind (Galen v. 751); yet of later authors Theophrastus is the first to mention him by name. As he was used by Aristotle and Praxagoras, and had a controversy with Diogenes of Apollonia, we are enabled to fix his date around 350 B.C. It was he and Philistion who added the four Hippocratic humours to the four elements and their qualities; in which doctrine Empedocles and Aristotle followed them. Valentin Rose thought indeed that Diocles might have been the collector of the Hippocratic books; but Wellmann says, a little incautiously in my opinion, that Diocles probably knew as much or as little of the Hippocratic books as we do. It would appear that Diocles had at least nine of the Hippocratic treatises before him, but chiefly the surgical; probably those which Menon also used (p. 241): and many of the treatises are cited by other writers of the period.

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[1] Aristotle attributed to Polybus the *De natura hominis* (Littré i. 217, vi. 58, and ix. 162 and 418). See also Professor D'Arcy Thompson (*Aristotelis hist. an.* Bk. iii. 512 b 12) on his opinion that the blood-vessels originated in the head.

[2] There is some confusion about the identity of this renowned Alexandrian physician, so often quoted by Galen. Wellmann (in P.-Wissowa) makes, in the later fourth and earlier third century, three of the name: (1) C. of Cnidus, disciple and companion in travel of the celebrated Eudoxus, who linked Sicily with the Lyceum, and was supposed master of Metrodorus, a son-in-law of Aristotle, who taught Erasistratus medicine in the Lyceum; (2) C., also of Cnidus, his grandson, disciple, with Eudoxus, of Philistion, master of Erasistratus, and leader of the Cnidian pneumatists in the time of Aristotle; (3) C., his son, called also C. of Rhodes, body physician to Ptolemy II., who died in the ruin of Arsinoë. But Wilamowitz-Mollendorff (*loc. cit.*) admits two only: (1) the teacher of Metrodorus; (2) of Erasistratus and Aristogenes; and denies the filial relation. See Wilamowitz, *Gr. Lesebuch*, Berlin, 1902. See also Susemihl, *Rhein. Mus.* N.F., 1901, lvi. s. 313-18. Chrysippus the Stoic, who lived a century earlier, was of course quite a different person.

Like Akron and Philistion, Diocles laid great stress upon diet, exercises, and baths; he wrote a treatise on Hygiene (addressed to one Pleistarchus) in several books. Animated by the Greek aversion to excess, he urged temperance in all things; notably in the extravagant gymnastics of the period, such even as those of Herodicus of Selymbria (p. 328). Not only were the doctrines of the four elements and their qualities carried forward by Eudoxus and Chrysippus (p. 138), pupils of Philistion, a pupil in his turn of Empedocles, whom, as we have seen, Plutarch called a brilliant forefather of Medicine, but also the no less ascendant doctrine of pneuma as the creative spirit of the world (*respiratio mundi*) and of man: of pneuma we are to hear a good deal in respect of respiration by lungs and by pores of the skin. Unfortunately in their physiology both Philistion and Diocles were *coolers*: *i.e.* they upheld Innate Heat, cooled by the lungs, against the combustion hypothesis (p. 259, see Galen iv. 471 and ii. 117, 140 K.). For Diocles digestion also depended on heat; so that large quantities of innate heat, and of pneuma, were needed in the stomach (p. 239). In the sufferer from chill the food grew cold and the blood thin (dyspepsia). The heat (ἔμφυτος θερμασία) promoted secretion, was generated within, and seated in, the left ventricle. The heart, with the Sicilians, Aristotle, Praxagoras, and the Stoics, he held to be the governor (ἡγεμών) of the body, and the seat of intelligence (φρόνησις) as well as of sensation; but pneuma, called also ψυχικόν, which entered by the trachea, and perhaps also by the cutaneous respiration, was for them a different entity; but for Diocles and the Sicilians the brain was hardly less in honour. Diocles maintained the Alcmaeonic conception of eucrasia (p. 99)—that health consisted in the balance of opposites in the body; *e.g.* the blood and yellow bile were hot, the phlegm cold, and so on.[1] As furthermore the diseases of winter were cold and moist, and those of summer hot and dry, their respective therapeutics were accordingly—*contraria contrariis*; so that, like Philistion, while dwelling on these internal causes, many of them very fanciful, Diocles accepted also the outward causes of disease. Other maladies were due to obstruction (ἔμφραξις) or waning of the pneuma.[2] The pneuma spread through the body by the blood-vessels (arteries); the heart, which carried both blood and pneuma, being the centre. Some, but not very clear, distinction was then made between the tracheal system, the arteries, and the veins; most definitely by Praxagoras. Aristotle had not made this distinction. Inflammation he attributed to stoppage in the blood-vessels of the part.

Although Galen respectfully banters him on the roughness of his dissections, Diocles was, as I have said, no inconsiderable anatomist and also a keen embryologist; indeed he is best known as the discoverer of the *punctum saliens*.[3] He seems also to have carried the distinction between the venous and arterial areas beyond Aristotle, and discovered and traced the course of some of the glandular ducts. He wrote the first work on Anatomy,[4] as he wrote the first on Hygiene, and the first Herbal. He described the lungs, heart, gall-bladder, liver, ileo-caecal valve, ureters, ovaries, and tubes. Galen says that he did distinguish arteries from veins; and he put blood into the aorta (παχεῖα ἀρτηρία), as well as pneuma which was delivered thence to the brain. He described the branches of the vena cava (*κοίλη φλέψ*) and those of the aorta. He saw that the spinal marrow was a continuation of the brain, and that nerves were conductors of sensation, although he placed the primary seat of sensation in the heart; the special senses however he put in the right hemisphere of the brain, the understanding (mind or reason) in the left. His anatomy, like that of Galen, was of course of animals only; it is the distinction of the Alexandrians, on the advantages peculiar to their city, to have founded the study of the anatomy of man. Unfortunately, too soon afterwards, human anatomy—never practicable perhaps in Athens where Diocles chiefly dwelt—became again impossible; and, save in respect of surgery, what had been gained in Alexandria seemed to the later doctors, as physicians are now prone to say of pharmacology and experimental psychology, too far from the sphere of clinical medicine to be of practical service.

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[1] See *Timaeus* 83 c–85; Wellmann's *Pn. Sch.*; and the Hipp. tr. on the *Sacred Disease.*

[2] We owe our knowledge of Diocles to Galen, Athenaeus, C. Aurelianus, etc.; see Wellmann, *Frag. Sic.*, *loc. cit.* See also Fuchs, *Rhein. Mus.* xlviii. 532, and, under the name of Od. Horatianus, a tract of Vindicianus, ed. Wellmann. Galen probably knew the works of Diocles (through Archigenes ?), as he knew those of Heraclides of Tarentum, only indirectly.

[3] On the testimony of Oribasius (iii. 78): "On the ninth day a few points of blood; on the eighteenth beating of the heart; on the twenty-seventh traces of the spinal cord and head."

[4] The Asclepiadae seem to have had no anatomical manual (Galen ii. 280).

Another physician whom I have mentioned as a founder of the Alexandrian school, namely *Chrysippus*, had travelled much, and learned of many; yet he seems to have retained the Cnidian habits of minute observation of instant detail, and of indifference to Coan reasoning upon remoter causes—such as we find for example in the treatise on *Airs, Waters, and Places;* though he was not without some tincture of academic logic. This sedulous obedience to fact it may have been which fortified in Alexandria the bent, inherited from Aristotle, to anatomy, surgery, and symptomatology; and sowed there moreover the seeds of the subsequent empiricism and scepticism. Chrysippus must have been a highly gifted man, for he seems to have originated a revolution in medical doctrines and practice (see p. 189). By tacking on many little points of agreement,[1] on some of which I may touch incidentally, as well as by the new ideas with which he enriched medicine, we shall be able to trace the influence of Chrysippus into later times; as for instance by the use of sweating baths in dropsy, and of certain medicinal herbs; by other methods of therapeutics also, especially concerning venesection on which practice, as I have said and shall have to repeat, that Chrysippus set himself against the whole of ancient medicine, and with that far-reaching effect on later generations, down to Galen, to which in the history of Asclepiades we shall have to give no little consideration. "Chrysippus the Cnidian," says Galen (xi. 150 and 252 K.), "who displaced (ἐξελών) phlebotomy altogether from our means of cure.[1] The works of Chrysippus were still extant in the time of Celsus. But to this important matter I shall return hereafter in some reflections upon the story of the pulse (Chap. XIII.). One main point is that, after Aristotle,[2] he attributed the origin of all the blood-vessels not to the liver but to the heart. He gave the same origin to the nerves, because he mistook empty arterioles for nerves (Chap. XIII.). It is curious that Aristotle did not recognise the coronary arteries, but attributed the nourishment of the organ to the blood in its cavities.

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[1] *Vide* Wellmann's useful lists in Susemihl, *loc. cit.*

I may remark that in Alexandria mathematics and natural science first detached themselves from other departments of thought, as from ethics and philosophy, and occupied a field of their own. Now, in endeavouring to elucidate the propagation and course of scientific ideas after Polybus, Diocles, and Praxagoras through the schools of Alexandria to Rome, we meet with the name of *Straton*. Unfortunately for the historian, the name of Straton, like that of Chrysippus, was attached to several individuals. Of these one, namely Straton of Lampsacus, son of Arcesilaus, tutor of Ptolemy Philadelphus, succeeded Theophrastus (288 B.C.) as head of the Peripatetic School, and held this position for eighteen years, when he was followed by Lycon. Now this was the Straton, a very able and positive thinker, who gave himself so devotedly to natural knowledge as to receive the cognomen of Physicus. He it was especially who gave to pneuma the excessive place in physiology which was continued by Erasistratus, who canalised it in the left ventricle (θάλαμος πνευματικός) and the arteries. Straton, says Diels, combined the ideas of Aristotle, Democritus, Athens, and Alexandria; he set up experimental physics, and studied medicine and eugenics. He occupied himself with the *horror vacui* that so much impressed Erasistratus, Heron, etc. In Alexandria was made the finer pocket water-clock with which Herophilus, "one of the greatest Doctors of all time," first counted the pulse.[3] Cicero

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[1] See also Neustadt, *loc. cit.*

[2] Aristotle was not strictly the first to attach the blood-vessels to the heart; Plato speaks (*Tim.* 70) of the heart as the knot (ἅμμα) of the vessels and the fountain of the blood. And for Aristotle, though not for Diocles, the aorta seems to have been empty of blood.

[3] See Marcell. *De pulsibus*, c. ii. ed. Schöne, Basler Festschrift, 1907, S. 463; and Max Schmidt, *Kulturhist.* Beitr. ii., Leipzig, 1912, S. 45, 101.

(*Quaest. acad.* i. 9 and *De fin.* v. 5) upbraids him, after the manner of Socrates, for so giving himself up to nature as to neglect the study of virtue. But there was also a Straton, presumably however the same person, an eminent physician of the third century, who was associated directly with Erasistratus. He was important enough to receive frequent mention over the later centuries from Themison and Soranus (who quotes him on prolapsus uteri), to Oribasius and Galen, and to Alexander and Aetius. He opposed venesection after the manner of his alleged pupil Erasistratus; he was the first physician, so far as we know, to describe elephantiasis; and Erotian quotes him as author of a lexicon of Hippocrates. Haeser seems to identify these two persons; Fuchs (in Puschmann) separates them. The unity or duality of person may be of no great importance, for, if two, they were both in the line of the same tradition; nevertheless the force and direction of Aristotelian influence is a question of the keenest interest. The Sicilian tradition was never wholly free from magical and Orphic bias; and the Platonic School, which was impressed by it, set back the inductive side of learning. If, like Bacon, Aristotle may seem to have lacked the larger imagination, and never to have apprehended, as did the Ionians, the infinity of the scope and subjects of speculative thought, yet by virtue of this very concentration he restored the method of research by the serial order of facts and, like John Hunter two thousand years later, brought together a vast collection of facts, acquired in great part by personal experience, but also by cautious inquiry not of philosophers but of practical men, such as fishermen and hunters. Now such, we are told, was the very influence which the efficient, if ambiguous, Straton carried to Alexandria. In his own work Straton attempted to base science on experiments; in particular we learn that he made systematic experiments on the vacuum.[1] So also Aristotle's extensive dissections of animals must have forwarded the study of anatomy in Alexandria. Furthermore, we know that Aristotle collected a large library, and that it probably became the foundation of the Alexandrian.[1] We have seen also that in collecting these books he did so with a view to a historical co-ordination of knowledge, for which end he organised writers in several departments: Eudemus was editor-in-chief; Menon compiled the medical literature;[2] Theophrastus that of minerals, of physics, and of botany; Aristoxenus that of music.[3] Sadly we deplore the utter destruction of all these documents; for little remains save the odour of the cask. Much of the destruction was also indirect; books were hidden, as during the "commandeering" of books in private hands by the kings of Pergamon. One Apellicon of Teos discovered many of them, grievously damaged by damp and neglect; damage which he tried to conceal by crass and ignorant emendations.

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[1] Empedocles is said to have observed that a tube closed at the upper end, if dipped into water will not fill; and if filled will not empty itself; but I have been unable to discover this statement in the fragments. However the general notion of a vacuum had been in the minds of philosophers, as of Plato, for a long time before. Lucretius took it as common knowledge (ii. 238) that through an unresisting void all things, though of unequal weights, must be moved and borne along with equal velocity.

By certain words and phrases we may trace the passage of ideas through the Alexandrian Schools; especially through Erasistratus down to Athenaeus, the last physician, as we shall see, to build directly upon Aristotle. For example, we recognise the ruling doctrines of Aristotle in the meaning of nature (φύσις)—concerning which Athenaeus definitely cites Straton, in the several kinds of the soul, in the hegemony of the heart, and in the theory of generation. Unfortunately for the study of origins the discoveries of papyri in Egypt have brought forth hitherto few ancient records of Alexandrian medicine.[4] However, besides the Menonian papyrus (p. 243) which deals with certain points in dispute between the followers of Herophilus and Erasistratus, Karl Sudhoff (Leipzig, 1909) has recently collected many interesting relics concerning drugs, customs, diet, and baths; also on temple and hospital matters: but no fragment of any great writer, nor any illumination of the history of ideas, has as yet turned up.

But, to proceed, so far as relics and fragments enable us, with this sketch of such features of Alexandrian medicine as reappear in Roman medicine, particularly as may concern the Pneumatists. Speaking very generally of its two great anatomists, Herophilus—

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[1] Concerning medical MSS. in public libraries, see Xen. *Mem.* iv. 2. 10 (and pp. 69-70).

[2] It is said (Suidas) that Aristotle wrote six books on Medicine, now lost.

[3] I do not mean that these men were mere compilers; certainly this would be very unjust to Theophrastus, Straton, or Aristoxenus.

[4] Even of later date the medical finds are scanty. Meyerhof and Pflüger discovered in a library in Cairo some unknown MSS. of Arabian origin on eye diseases; and Meyerhof adverts to such relics in Damascus and Constantinople. Probably these will prove to be translations of older known treatises.

one of whose masters was the Coan Praxagoras, an immediate follower of Hippocrates, and perhaps the last of the Asclepiad guild—led more directly from the Hippocrateans to Galen; Erasistratus rather from Cnidus to the Methodists and Pneumatists. Eudoxus and Chrysippus taught to Erasistratus (b. 320?) the physiology, partly pneumatist, partly humoral, of the Sicilian Philistion (p. 135); thus, as I may reiterate, uniting the Sicilian and Cnidian traditions, and these with the Lyceum. Moreover Erasistratus was bound to Cnidus by family ties. Metrodorus again, a pupil of Chrysippus the elder of Cnidus, the third husband of Aristotle's daughter Pythias, and according to Sextus Empiricus one of the teachers of Erasistratus (p. 149), was of the Lyceum. Furthermore, Erasistratus was probably a pupil of Straton also, and may have heard Theophrastus; thus it came about that for Erasistratus pneuma was only cooperative, not innate nor the beginning (ἀρχή); and that, under this peripatetic influence, Erasistratus favoured the doctrine of cardiac heat, and of the lungs as cooling fans.[1]

When we try to get a little nearer to the facts than this, the respective disciples, or nominal disciples, of these masters perplex the modern historian by their manifold inconsistencies; vagaries in which the Herophileans, like the later Galenists, particularly erred; even forfeiting the birthright of their school by shirking its anatomy and, with the frowardness of the Christians after them, dissipating their master's teaching in sophistries, and in the elaboration of a wire-drawn dogmatic system built upon the flimsy foundation of glosses and commentaries on the texts; although these were then intact in the vast libraries of their city. So it was that the name of Dogmatists became attached to this school; if I remember right by Galen. In working rather by the letter than in the spirit of their great ancestor Hippocrates, spinning abstract notions and systems, and neglecting observation and criticism, they became the Pharisees of Ancient Medicine. These formalists were however more or less broken up by the positive Alexandrian anatomy and surgery, and by the empirical and sceptical schools. The Erasistrateans were more steadfast; save in their notion of empty arteries, they kept closer to nature, and seem to have adopted much of the more positive teaching of Straton the Aristotelian; they practised some anatomy at any rate even down to the second century A.D. (Galen); and on the empirical side did better service than their dogmatising rivals. Accordingly in the early Empire the Erasistratean School on the whole prevailed.

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[1] I am indebted here to Jaeger's papers in *Hermes*. Of the very words of Erasistratus we have none; but for sources, see also R. Fuchs, *Hermes*, Bd. 29, 1894; and his Berlin Diss. of 1892. Fuchs promised us more on the matter, but I think no more has yet appeared. The Dissertation I have been unable to obtain.

From these and some other sources, from Celsus and in part from Galen who, in philosophy and literature as in medicine, was a late Alexandrian, we learn that in the period of comparative peace which ensued in Alexandria after the internecine strife of the Diadochi until the expulsion thence of the physicians and the *savants* to the islands and Asia Minor by Ptolemy VII. (Physkon) —a strange contrast to his predecessors—and before the diversion of the main stream of culture from Alexandria to Rome, burst forth that brilliant school of which we know so much by the glory of its renowned achievements and so little by its documents. Moreover, under the Empire and even in the later years of the Republic, the intercourse between the two cities both in trade and culture had become easy and continual. Celsus, for instance, in his therapeutical advice to consumptives, speaks of the voyage from Italy to Alexandria, even in the petty craft of those days as "aptissime." In Alexandria then Hellenism had its fling; touched however more and more by Oriental influences, especially of Syrians and that learned and ingenious race the Jews,[1] of whom even then there were many in the city; influences which a little later, in the Neo-Platonic and Christian Schools, became potent, and even ascendant, down to the second great fire of the Alexandrian libraries in the fourth century.

A very interesting work on human anatomy, pathology, and therapeutics, a part of which was originally composed by a learned and distinguished Alexandrian physician, has been translated by Dr. Budge[2] from the syriac. The manuscript is mutilated, and the name and date of the author are lost, but we perceive that he was an earnest follower of Hippocrates. As our knowledge of the Hippocratic tradition from Aristotle to Galen is, as we have seen, slight enough, any supplement of it is very welcome. The book was translated into syriac about the twelfth century.

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[1] It is said that in the reign of Augustus there were a million Jews in Alexandria; and we know there were Jewish physicians in the first century A.D.

[2] *The Syriac Book of Medicine,* 2 vols., Oxford, 1913.

This edition of the *Syriac Book of Medicine* is not the least of the distinguished services of Dr. Budge to letters. It consists of two parts, or sections, no doubt of different date and authorship, and of very different value. The second section consists of astrological notes and folk-lore recipes; many foolish or disgusting, all more or less ignorant or superstitious. Dismissing this, and turning our attention to the first section only of the Book, we find in it matter of a very different value. It is probably a translation from greek to syriac by a Syrian physician, apparently a Nestorian. He lauds Diocles and his work. The medicine is in character Hippocratic; the physician concerns himself with natural laws and causes, and accordingly his methods of dietetics and treatment are expectant on nature. He urges good sanitation; that the house shall be cool and airy, the clothing appropriate to the season, the drinking water pure and running, sleep sufficient, and so on. He is openly defiant of all magic and priestcraft, which the Syrians certainly were not; he is modest of his own abilities, and makes no appeal to ignorance or credulity. He says well that without accurate diagnosis there can be no success in therapeutics. On the other hand he is narrowly a " practical " or clinical physician. His anatomy is early and weak; he has learned no distinctions between veins, arteries, nerves, tendons, or ligaments. He works simply in the four elements and the four humours.[1] Dr. Budge looks upon him as of the Alexandrian school, but, if so, he must have been of a decadent branch. We may suppose that the pupils of such anatomists as Quintus and Marinus would have been better up in their anatomy than this. If however Alexandrian by scholastic descent he was more Herophilean than Erasistratean. Greek was a familiar tongue in Syria, which, at any rate in the upper ranks of its society, was a bilingual country, as in the example of Zeno of Apamea; and again in the familiar names of John Mark, Simon Peter, and the like. Its culture was indeed far more greek than semitic; and Syria was " almost conceitedly ignorant of latin." Moreover, unlike the Romans but like the rest of the Eastern Mediterranean peoples, the Syrians were great travellers; like the Greeks they were versatile and imaginative in temperament; and, as we may perceive in Lucian, humorous and satirical, though far behind the Greeks in height and breadth of endowment. Still, when we remember the greatness, wealth, and splendour, and the fatal luxury of such cities of Syria as Antioch, Edessa, Berytus[1] and others, we may picture to ourselves the incessant stream of philosophers, physicians, artists, merchants, and literary and scientific men, many of them holding important official positions, which flowed thence into Byzantium, Greece, and Rome. I think it is Dr. Budge who reminds us of a Syrian Bishop of Paris, surrounded by his compatriots; and Gregory of Tours says that syriac was still spoken in Orleans in the fifth century. Thus may we imagine something of the influence of Syria directly and by the mediation of the Arabs, and of her contributions to social and literary activities in the West. Of this influence of Syria we have a still better known illustration in its effects, especially on the emotional and ascetic side, upon Christianity and the New Testament.[2] The Syrians were fertile heresiarchs, and did much of the forcing of half-comprehensible, and indeed unknowable, things into the formulas and logical categories under which still to-day we are suffering and divided. Personally, since the old days of Renan's ascendancy, I have thought Syrian literary history much undervalued, and have regretted the scanty results, save for fine pottery, of archaeological research in its ruined cities now desert. What Syria and the Nestorians did for the restoration of Aristotle is known to us all, but curiously enough we have no evidence that Archigenes or Posidonius (p. 276) owed much to their Syrian nurture.

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[1] Speaking generally, the cuneiform inscriptions are more humoralist, the Egyptian more pneumatist.

We have seen then that the powerful and insatiable mind of the Greek, from Anaximander to Plato, before the discipline of observation and analysis initiated by Hippocrates and Aristotle, had conceived certain general ideas of cosmic scope and significance. These ideas once apprehended, the edifice of orderly knowledge had to be built up by more laborious methods. The difficulty then lay in the gearing of this tremendous thinking engine to practical work. While unharnessed, it spun about itself with enormous velocity, weaving out of its own dust what Francis Bacon called its cobwebs. Such buzzing and ineffectual revolutions are almost more apparent in the first centuries after Christ than in the thirteenth. For a season however in Alexandria this tremendous energy was buckled to the real work of spinning webs, not of notions only but of facts—of things, that is, which had happened, which were happening, and which experimentally might be made to happen. And in the Aristotelian tradition we know how brilliant were the results of these Alexandrian scientists, not only in celestial and terrestrial physics, but also in biology. In this College at any rate the names of the great anatomists Herophilus and Erasistratus are even more familiar to us than those of Euclid, Aristarchus, Archimedes, Ptolemy, Hipparchus, or Heron. The Greek capacity for scientific discovery, and for the methods of it, seem to have been greater in the third than in any other century B.C.; the swift and glorious development of Greek science in Alexandria is comparable with that of the immortal art of the homeland. It is an interesting question how far the chastening influence of scepticism, so valuable in scientific training and research, yet may have damped the finer ardours of imaginative and creative conception.

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[1] Berytus is often spoken of as a large school of Medicine in the time of the Herods, but, as I have said, like Bologna, its strength was rather as a School of Law. On the Moslem conquest of Syria it fell to a low rank in all faculties. Most, or many, of the ancient "universities" were of one or two faculties only.

[2] Dr. Budge says that to Syria we owe the emblem of the crucifix.

Herophilus,[1] the great demonstrator of the brain, born at Chalcedon, and so, like Asclepiades, a Bithynian, lived and worked in Alexandria under Ptolemy Soter, the half-brother of Alexander, and founder and great benefactor of the school; and perhaps in part under the second Ptolemy. In the eastward expansion of Greek scientific culture his doctrines were carried to Pergamon, and later to Laodicea. It is worth remembering, in respect of the tradition leading down to Galen, that under the Attalid kings Pergamon was, at some interval, comparable in culture even with Alexandria; and schools were perpetuated there till Galen's time, although apparently with some decline; for we are told that when in Caesar's campaign the library of the Museum—not of the Serapeum—was burned, the Pergamene library was brought to Alexandria, but only at a later time to be destroyed, with the Serapean, by religious fanatics. The school of Smyrna, on the other hand, by way of which, as we shall see, the prescription of wine as a medicine probably reached Asclepiades and Athenaeus, was founded, as we learn on the contemporary authority of Strabo, in the first century B.C., by Hikesios, and he was an Erasistratean.[1] But to return to Herophilus; Haeser reminds us that, great as were his researches in anatomy especially as regards the nervous system, yet before him Praxagoras of Cos, an Asclepiad and "Dogmatist" (*i.e.* humoralist, etc.), contemporary of Chrysippus, a little after Diocles, seems to have made no inconsiderable advances in this study. Unfortunately, save a few fragments in Galen and Caelius Aur., his works are lost. We gather however that he had already distinguished, for instance, between the motor (*προαιρετικά*) and the sensory (*αἰσθητικὰ*) nerves, although he presumed that the sensory nerves arose " in the centre of feeling—the heart." But over the earlier schools,[2] as also over Galen and the later, the Alexandrians had the incalculable advantage of dissecting the body of man.[3] Herophilus, being thus through Praxagoras, of Coan tradition, which made the brain the centre of mind and energy, advanced to the demonstration of the origin and course of the nerves from the brain and spinal cord (Galen viii. 212), and described many parts of the brain, including the meninges; for he championed this noble member—regarded by Empedocles, Diocles and the Aristotelian school, as little more than a refrigerator for the inward heat and secondary to the heart—as the source of sensation, thought and vital energy. This faculty, or these, he placed provisionally in the ventricles.[4] On his description of the liver, pancreas, duodenum—to which he gave its name—the chyle-vessels, and many other members, descriptions new in part, in part enlargements of previous knowledge, I cannot now dwell; but to his important researches on the circulation I shall return presently, when we come to discuss the pulse lore of this period and of the Roman pneumatists. Herophilus described the anatomy of the eye, and was perhaps the first to describe the lens; we know from Aetius that he wrote a treatise *Περὶ ὀφθαλμῶν*. He worked also and well upon the organs of generation and on childbirth; indeed there seems to have been no part of the body which this anatomist did not investigate. He must have been one of the earliest gynaecologists, as in Hippocratic times only women attended upon women. To this great and precise observer Galen was deeply indebted (see Gal. viii. 716); yet in respect of the nervous system these Alexandrian anatomists never quite cleared up the confusion under the name *νεῦρα*. They still regarded nerves, tendons, and small arteries, as varieties of one kind; varieties because they did perceive that the nerves came from the brain and spine, but the tendons from the bones and muscles.[1]

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[1] For Life of Herophilus see Marx's edition of what remains of his works (Göttingen, 1840). Also Greenhill in Smith's *Dictionary*. Also again the medical sections in Susemihl (*op. cit.*), which in large part are from the pen of Wellmann.

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[1] Strabo xii. 580.

[2] That is, speaking generally. Galen credits Diocles with some knowledge of anatomy (p. 137); and there is reason to suppose that both this physician and Praxagoras, and so presumably some others, had dissected the human body. But in Alexandria there was an Anatomical Institute in which human bodies, as Galen says plainly concerning Herophilus, were dissected (ii. 895 *οὐκ ἐπὶ ἀλόγων ζώων καθάπερ οἱ πολλοί, ἀλλ' ἐπ' αὐτῶν τῶν ἀνθρώπων πεπονημένος*).

[3] Much more evidence would be necessary to compel us to believe the malignant insinuation of Tertullian that these anatomists opened the bodies of living men (criminals). Such brutality, if not alien to the Roman, was foreign to the Greek temper. Dr. Crawford has reminded us (*Harv. Or.* 1919) that had the Alexandrians dissected any warm-blooded animal alive the notion of empty arteries would have come to an end.

[4] *Τὸ τῆς ψυχῆς ἡγεμονικὸν καθέζει Ἡρόφιλος ἐν ταῖς τοῦ ἐγκεφάλου κοιλίαις* (Gal. xix. 315 K.), as did Galen. Erasistratus put *ψυχή* as the convolutions.

Aristotle (*Hist. an.* iii. 5) regarded the heart as a muscle with sinews, as it had within it the chordinae tendineae, etc.; the aorta was known as "the sinewy vessel" whose ramifications ended in tendons; for when empty after death they appeared as such. "By '*neura*' Aristotle meant sinews, ligaments, and all fibrous tissue" (W. Ogle); and, so long as nerves were not clearly distinguished from these, there could be no understanding of voluntary muscular action; this distinction was first discerned by Herophilus and Erasistratus, who demonstrated thence the connexions of the nerves with sense organs and brain. But indeed Alcmaeon had perceived this connexion (p. 99). Furthermore, Herophilus pointed out that anaesthesia occurred in some palsies, not in others (Gal. *loc. cit.*).[2] Beside his examination of the viscera—of the liver, of the pancreas—he named the "duodenum," described the mesenteric circulation, and demonstrated the pelvic viscera in both sexes.[3] Herophilus compared also the venous with the arterial coats, and showed that blue blood went to the lungs and red blood to the aorta; but his description of the heart and its parts was far behind that of Erasistratus.

The main functions of the body (*δυνάμεις*) Herophilus classed as four :—nourishment (the nourishing soul), which had its seat in the liver ; heat and animal power (the warming soul), which he placed in the heart ; thought (the thinking soul), which had its seat in the brain, and sensation and motion (the sensory soul) which he attributed to the nerves. For Galen, as we know, the "souls" were three. As a physician Herophilus, in opposition to Erasistratus, accepted the four humours of Hippocratic tradition (*Cels. Prooem.*), and opposed him furthermore in matters of pharmacy, dietetics, and hygiene ; subjects with which he dealt at large in a work Περὶ αἰτίων[1] (see Pliny, *N.H.* xxvi. 30) ; but his temperament was that of an observer, and he wisely avoided the speculative discussions of his epoch. Although he paid no little attention to food, regimen, and exercises, yet he relied far too much upon drugs. We shall see more of this contrast under Erasistratus.

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[1] See Daremberg's edition of Rufus.

[2] *Ἔνιαι μὲν τῶν παραλύσεων αἴσθησιν μόνην, ἔνιαι δὲ τὴν προαιρητικὴν κίνησιν, ἔνιαι δὲ ἀμφοτέρας διαφθείρουσι.*

[3] Susemihl, *op. cit.* i. 785 ff.

That the doctrines and influence of the chief Romano-Greek physicians—Asclepiades, the Pneumatists, Galen, etc.—cannot be understood without a previous understanding of their great Alexandrian predecessors is especially true of *Erasistratus* who, both as anatomist and physician, occupies a cardinal place in the history of medicine. More than any other of the school he reconstructed medical doctrine. Unhappily, in his case likewise, by neglect of his stronger parts and inflation of his weaker, his followers contributed to the decline of the Alexandrian anatomy and physiology ; so that Greek Medicine fell more and more into the shade until their brilliant but only too transitory revival by Galen. The intellectual pedigree of Erasistratus may be resumed in some such fashion as this :—[2]

Democritus (460–357 B.C.)—Chrysippus the Elder (Cnidian, p. 138), after Hippocrates, about the time of Aristotle ; (atomic theory, physiology and the pneuma, see Galen, iv. 707)—Metrodorus of

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[1] A certain Heracleides Erythraeus, lauded by Galen (ii. 17.65) ; not the great Tarentine, but a contemporary of Strabo about the Christian era (placed by error in Haeser in the third century B.C. ; there were three or four physicians of the name) wrote a long treatise on the "sect" (*αἵρεσις*) of Herophilus, but unfortunately nothing of it remains. It is strange that even in the time of Galen the many and considerable works of Herophilus had become very scarce : probably displaced by epitomes. Little now remains but the scraps in Galen (Marx, *l.c.*).

[2] The chief sources are Pliny (*N.H.* xxix. 5), Sextus Empiricus, Diogenes Laertius, Galen (vols. v. 707, vi. 495, xi. 191, and xvii. A. 873), Caelius Aurelianus, *Chronic Dis.* ii. 13, etc., Val. Rose, *Anecd. Graeca* ii. 226, *et seq.* ; and especially Wellmann's *Pneumatists*, and his articles in *Hermes* (xxxv.) and in Pauly-Wissowa. For the influence of Aristotle at Cos and Alexandria see the doubtful treatise Περὶ πνεύματος.

Athens (son-in-law of Aristotle), and the Peripatetic tradition carried in all its vigour to Alexandria when this city became the centre of Hellenic culture)—School of Praxagoras in Cos (fl. 340–320 B.C.), Mnesitheus—Chrysippus the Younger—Eudoxus of Cnidus in Alexandria (*c.* 366 B.C.) (in touch through Philistion with Ital.-Sic. school)—Erasistratus[1] (born *c.* 320; he was at the court of Seleucus in 293). (Helm, *loc. cit.*).

A rich and various pedigree; Coan (Ionian), Cnidian, Pythagorean, and Aristotelian.

In the third century B.C. medicine, anatomy and physiology were, in practice as in substance, one; Herophilus and Erasistratus were as distinguished in the practice of medicine as in anatomy. Herophilus walked, as we have seen, in conservative ways; Erasistratus seems to have been a man of a more ingenious, if not more original mind. As an anatomist Erasistratus, like Herophilus, is best known for his researches on the brain and on the circulation. They both contested Aristotle's hegemony of the heart, and, distinguishing between motor and sensory nerves, traced them to their origins in the brain. At first they supposed the nerves to be tendinous prolongations of the dura mater, but Erasistratus detected the pith in them, and this he traced to the cerebral substance (Galen v. 602). They compared the convolutions of the brains of man and animals and, attributing intellect to them, restored to the brain its pre-eminence. Erasistratus demonstrated certain palsies as consequences of cerebral lesions. Still more interesting was the work of Erasistratus on the circulation; indeed in the middle of the third century B.C. he got very near, nearer than Galen, to the illustrious discovery of Harvey in the seventeenth century A.D.; that is to say, the world of science halted upon the confines of this cardinal revelation, or fell back from it, for 2000 years. Erasistratus failed, not because he apprehended and this rightly, the presence of some lifegiving gas (πνεῦμα) in the arterial circulation, but because, like his teachers Praxagoras, Chrysippus, and other physiologists—then, before, and after, he saw in these vessels no, or but little, other content. Empedocles, and probably Diocles, seem to have thought that certain vessels (the arteries) contained blood, but not in quantity to fill them; the rest of space being occupied by air or pneuma. This hypothesis, and Galen's of the permeability of the cardiac septum, are among many crucial instances in the history of science of blindfolding by preconception. In early Egypt, as we learn from the papyri Ebers (103. 1) and Brugsch (15. 1), the veins were supposed to contain blood, and the arteries air. Egypt was attached to the idea of the pneuma ; the Orient—*e.g.* the Jews—of the blood. William Ogle is sure—I cannot say I am—that Aristotle knew that what we call "arteries" contained blood ; for Aristotle of course "arteria" meant the trachea. The magic of the aerated blood enthralled Erasistratus, as it did many generations of men, and disturbed the compass of his scientific vision ; but to represent him, as Diels does, as a physician who "pushed pneuma-doctrines to an absurd extent," is an overcharge. A like puzzle about contents put Erasistratus, and probably Herophilus also, off the discovery of the lacteal channels : this was left to Aselli because, if on some occasions, when full of chyle, they were visible, at other times when they shrank out of sight, they escaped observation. The farther recognition by Erasistratus of the function of the epiglottis, which had been shown by Aristotle, put an end to the odd but long prevalent notion[1] that some of the food or drink passed into the lungs, there to nourish the pneuma[2] (Philistion, Diocles—Plato's authorities) ; and it is strange that he did not therefore distinguish the function of the trachea more clearly from that of the arteries (p. 303). Again, Erasistratus demonstrated the muscular fibres in the walls of the stomach, and the action of the thoracic muscles in breathing. In the circulatory system he described the heart and its parts more completely ; he made moulds of the cavities, and recognised the design and mechanics of the aortic valve, and indeed of all four valves. The function of the right ventricle (these ancients did not regard the auricles, particularly the right, as appertaining to the heart proper but to the vascular system) he perceived more correctly. Harvey, was, I think, the first to point out the pulsatile function of the auricles. As for many generations, so for the fourth and third centuries B.C., the vena cava was the great blood-vessel of the body ;[3] from it

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[1] Comrade of Nicias and friend of Theocritus the son of Praxagoras (p. 301) (see *Id.* xi.).

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[1] See Plato, *Tim.* 91 : "The passage for the drink by which liquids pass through the lung, under the kidneys and into the bladder."

[2] See nourishment of the pneuma, p. 226. *A propos* W. Ogle quotes Alcaeus *τέγγε πνεύμονας οἴνῳ* (*Frag.* xviii.) which, even if symbolical, follows the tradition.

[3] We must avoid the confusion of translating *φλέψ*, which means *blood-vessel* (of any kind), as "vein" ; and *ἀρτηρία*, which means air-way (*e.g.* trachea, etc.), as "artery."

Erasistratus taught that the blood passed into the right ventricle, where the tricuspid valve prevented any reflux ; that the pulmonary artery carried it thence into the lungs ; where again the semilunar valve prevented reflux. Beyond this point he was at a loss ; that in necropsies the arteries were quite empty was familiar to every eye, and the pulmonary veins also, appearing to him as arteries, were taken as empty of blood. From them he supposed that the pneuma, created in the lungs from the air, poured into the "thalamus pneumaticus" (left ventricle) ; stretching the passive chamber and its arteries (Rose, *An. Med.* ii. 226, and Galen xvii. A 873). Thus in his view the respiration and circulation were associated in function, though each had an independence of its own. Galen (*De usu resp.*) pointed out that on compressing the trachea the heart still continued to beat, although more quickly. But with the story of the circulation I shall deal more fully later, in the chapter on Pulse Doctrines (p. 300).

As regards supply of the tissues, Erasistratus conceived truly the "structural triplet" (Galen iii. 538. τριπλοκία) ; that is, an artery (to carry pneuma), a vein (to carry food), and a nerve (no longer quite confused with sinew, but regarded by Erasistratus as a channel containing psychic pneuma)[1] for motion or sensation. He pointed out also that the arteries were nourished by blood-vessels in their walls. For the tissues nourishment escaped from supposed finest vascular twigs (λόγῳ θεωρητά) ; not by open ends but by an oozing through pores in their walls (κενώματα)—substantially Aristotle's opinion—into the viscera (parenchyma) of *both blood and pneuma* (Anon. Lond.)—or, as we should say, of arterial, or oxygenated, blood. In the Περὶ πνεύματος (c. 4) the nutritive fluids are supposed to pour into the tissues from open ends. Of course in ancient times there was no histology. Aristotle, and probably most other biologists, supposed muscle to be a conglomerate of blood-vessels and clotted substance thrown out by them. No ancient physiologist was more impressed than Erasistratus with the phenomena of oxydation ; and if in the lack of chemistry he carried the idea of the pneuma to an extreme, and conceived it too mechanically, we shall hesitate to accuse him of "absurdity." Galen did not make matters much better by pleading that Erasistratus, being ignorant of innate heat, could not have understood the problem.[1] For him the pneuma was twofold: that of the viscera was the animal spirit (*πνεῦμα ζωτικόν*); that of the brain the psychic (*πνεῦμα ψυχικόν*).

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[1] Praxagoras seems to have been the first to recognise the nerves as media of sensation ; though he likewise failed to distinguish clearly between nerve, sinew, and empty arterial twigs.

The doctrine of the pneuma, handed on to Alexandria by the way we have seen, was not the only philosophic basis of the physiology of Erasistratus. As this doctrine passed from Erasistratus to Asclepiades in Rome, so the atomism of Democritus, adopted by Erasistratus who discarded the four elements, laid the foundation of Methodism. I have pointed out already that in the rigid plenum of Parmenides the idea of molecular motion was inconceivable; to give play to the vibration of molecules there must be spaces—"pores"—in the substance of what we call matter. It is not easy to state precisely the difference between the Democritean continuous vacuum (*κενὸν ἀθροῦν*) and the finely divided scattered vacuum, or vacua, of Erasistratus (as Galen expresses it, *κατὰ βραχὺ παρεσπαρμένον τοῖς σώμασιν*—sprinkled through bodies, see p. 106); nor need we here pursue this problem into refinements. And of the bearing of the atomic hypothesis upon the doctrine of Methodism, as represented by Themison, Soranus, and others in Rome, we shall learn more presently. Suffice it now to say that from this time onward more attention was given to the pores than to the atoms.

In pathology Erasistratus was a strong advocate of necropsies: he demonstrated disease of the liver (see p. 197); noted lesions of the liver, colon, and bladder in snake bite; and formulated a hypothesis of jaundice. He verified the rise of the pulse rate in fever, and described the relations of fever to inflammation as an epiphenomenon. He supposed that in fever, in wounds, and other lesions, the blood rushed into the arteries by way of hypothetical anastomosing channels between themselves and the veins (*παρέμπτωσις*), so flooding the arteries, and causing red face, heat, acceleration of breathing, cardiac excitement, and so forth. Although, after Chrysippus, opposed to venesection as a robbery of blood which was the life, yet, according to Chrysippus and farther back to Aegimius of Elis (see Anon. Lond. p. 241), he laid much emphasis upon plethora, which he attributed to overfeeding, and regarded as a fertile cause of disease (*Hermes*, xxxv. 375). He preferred however to treat plethora rather by a light and spare diet than by venesection; excluding meat, and forbidding self-indulgence. He was likewise opposed to drastic purgation. This discountenance of bleeding and purgation, as continued in Rome by Asclepiades, and the medicinal use of wine, gave rise to long and acrimonious controversies and vituperations (p. 331).

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[1] See R. Fuchs, *Hermes*, xxix., 1894.

The link, or one important link, between Erasistratus and Asclepiades was Cleophantus, a surgeon, physician, and gynaecologist of mark, whose influence on later physic was considerable (Pliny xxvi. 8 and elsewhere; also Celsus iii. 14). Their milder system of treatment, as received by Asclepiades from Erasistratus and practised in Rome, was of a less meddlesome kind than before. We shall see that it consisted largely in discard of all "heroic remedies"; in study of external and intrinsic causes in opposition to the Empirical School; in waiting upon Nature—"the great artisan"; in analysis of each individual case, apart from abstract rules; and in treatment by diet, and by physical means (Galen vi. 495)—such as sweating baths in dropsy—as prescribed by Chrysippus the Cnidian, massage and exercises; which last Asclepiades in Rome carried to some foolish extremes, as in his swinging cradles. The chief Alexandrian physicians stoutly opposed all occult agencies, and in some part the polypharmacy which Chrysippus and the Italo-Sicilian school had imported from Egypt.

In the study of Hygiene—this name and the idea seem to have been taken from Diocles—Erasistratus, and after him Asclepiades, showed the rational Ionian spirit; they taught that health consisted in balance and stability of function (*εὐταξία καὶ αὐτάρκεια*; see Alcmaeon, p. 99) and urged the importance of forestalling the first deviations from equilibrium, "as a pilot prepares for a storm"; for "thus is the skill of the physician most useful and most successful." In so proclaiming, after Erasistratus, the cure of disease to be *cito, tuto et iucunde*, we shall see that his follower Asclepiades brought upon himself the reputation of a plausible and pliant time-server (p. 184). And Asclepiades' reputation suffered none the less, as we shall see, from his repudiation of the humoral teaching of Hippocrates, a revolt also implicit, and indeed explicit, in the physiology of his master Erasistratus. Not that either of them denied dyscrasias; indeed to such depravations (cacochymias due to dyspepsias) Erasistratus attributed apoplexy, liver disorders, and other maladies; he said little however about "coctions." In fact he almost degraded digestion to mere attrition. His denunciations of Hippocrates, and those of his Roman disciple Asclepiades (p. 185) have loomed, in the clouds of controversy, enormous. After all in Roman mouths, as under Louis XV., Hippocrates had become a kind of Mrs. Harris. Yet on the other hand we are told that Erasistratus learnt Hippocratic treatises by heart, as he did Homer, and recited them in public. His perverse side was, in his search for oxygen, the fanatical insistence upon a merely pneumatic system of vessels, that indeed blinded him even to his own dissections; as in respect of the function of the kidneys and ureters (p. 173). Not only did he thus ignore the obvious and recognised urinary mechanics, and evaporate likewise the mechanical structure of many other secretions, but went to the absurd extreme of saying that not these only, but other secretory organs, and also the spleen were useless (*μάτην γεγονέναι*); thus forgetting the words of the "Master of them that know" *οὐδὲν γὰρ ποιεῖ περίεργον ἡ φύσις*;[1] which sentence was the immediate origin of "Ockham's razor" (p. 98 note[1]).

In surgery Erasistratus, as might be supposed of a great anatomist, was expert. He designed a catheter of a peculiar curve; he performed laparotomies, and drained empyemas in the several parts of the body. But we tremble when we read that he opened the abdomen to apply remedies directly to the peccant organs (Cael. Aur. *M.C.* iii. 4). It is a grave misfortune that the treatises of these great physicians seem not to have survived, even into Imperial times. Certainly they had perished in Galen's day, and apparently in the time of Celsus; perhaps they were destroyed in that sack of Alexandria which stained the great fame of Julius. For, as an author, Erasistratus was at least voluminous; relics or other mention of about sixty-two of his works are to be found in Galen, Caelius Aurelianus, and some other sources. In reading the strictures of Galen upon Erasistratus we have therefore to remember that Galen probably had not before him the works themselves, but fragments only and traditional reports.

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[1] Arist. *De part. an.* iv. 11. Theophrastus has perhaps some claim to priority in the formula (p. 98 note[1]). Thus it was that Aristotle was so perplexed by rudimentary organs; *e.g.* of limbs in the Cetacea. He could only guess that they were put there for appearances' sake—*σημείου χάριν*, out of respect for the pattern.

We are told (see Susemihl, *loc. cit.*) that up to the end of his life Erasistratus was still busy in research and in extending and correcting his notes.

Of the rest of the Alexandrians most of our records consist of names only. Marinus (p. 293) was classed by Galen with Herophilus and Erasistratus. Eudemus, also a great anatomist, demonstrated the abdominal system of glands, and certain bones of the fingers and toes. Cleophantus, an eminent physician and surgeon of his time (p. 162), had, as we have seen, much influence in simplifying therapeutics, and directing practical methods towards a truer hygiene and physiology. Andreas on the contrary (p. 363) was a Herophilist, and a druggist: Dioscorides praised him, indirectly through Sextius Niger, and pillaged his works. Pleistonicus, of the school of Praxagoras, wrote a treatise Περὶ χυμῶν in which he interpreted digestion as a fermentation (coction); and said water was a more proper drink for the stomach than wine (Ath. ii. 45 D). I mention him as perhaps the first teetotaller: a distinction not clearly pertaining to Pindar.

It would have been well if medical science could have continued patiently on these more positive, although latterly it must be confessed still somewhat nugatory, methods. It has been the trial of Medicine that while, as compared on the one hand with the no less complex but far more accessible phenomena of law and politics, and on the other with the far less complex phenomena of the physical sciences, it has stood, and stands still, in respect of the difficulty and inaccessibility of its knowledge, at a great disadvantage; yet, in no unnatural impatience with these perennial bafflings and obscurities, the moan of suffering men and women and the poignant misery of their children have ever driven us into action, however blind, however premature. Remedies, orthodox, empirical or quackish, one way or another, remedies by whatsoever means, have always been imperiously demanded of us. And, as nowadays the modern physician cannot wait for pharmacology, which seems to him, and not unnaturally, to be the tortoise behind the hare of empirical practice, so after a like manner we may imagine the impatience of Alexandrian physicians, sick of the pursuit of anatomy. Except in respect of surgery, the lost anatomical treatises of Herophilus himself could, it is true, have contained but little of any immediate application to inner medicine. In comparing these two great Alexandrian physicians, Herophilus, although in his propensity to drug therapy less admirable than Erasistratus who led the way towards a more physiological method—such as that of Asclepiades, seems nevertheless to have been a sound clinical physician after the Dogmatic tradition. This we may gather indirectly even from Galen's animadversions, when he says that Herophilus was lacking in logic (science),[1] and relied too much on experience and empiricism. As I have said before, Galen was not always a trustworthy witness, but Herophilus probably had a better eye for facts than mind for hypotheses.

Such then in the middle of the third century B.C. was the ground in which, in spite of its scientific spirit, or perhaps engendered by it, empiricism and medical infidelity would readily spring up and, gyrating in the void of positive knowledge, would, and did, give rise to weary and endless disputes and logomachies —*Federkriege*, as Susemihl calls them. And, while professing much reverence for Hippocrates, later physicians broke loose not from anatomy only, but also from the Hippocratic rational sagacity. In the third century B.C., as we learn from that earliest extant essay in medical criticism the Introduction of Celsus, and from other sources, Philinus of Cos,[2] the reputed founder in Alexandria of the Empirical School, and Serapion, who a little later harshly straitened it, instituted the schism in which walked with more or less discernment their eminent successors, such as Apollonius of Antioch, Herakleides of Tarentum (p. 370)—whom Soranus calls the most persuasive of them all, Menodotus, and Sextus Empiricus.

It was towards the end of the second century B.C., under the evil rule of Ptolemy Physkon, that Alexandrian science had begun to dwindle. Hipparchus, who had flourished about the middle of that century, was the last of the great originating minds ; yet the school, even in Galen's day, still retained so high a reputation that he himself studied there, and urged his pupils to do the same—especially for anatomy. And in the time of Strabo the great school of the Herophileans at Laodicea was still surviving. However the disinterested search after knowledge for its own sake had dropped into an industrious and respectable assiduity ; or into the technical furtherance of the crafts, especially of agriculture. Accordingly, we find then the beginnings of those summaries and compilations which, admirable as they were in Varro and Celsus—two of the most scientific of the Romans—covered the retreating footsteps of Urania. Thus the field was left open for astrological phantasies and for the marvels of zoology that, engendered in the East and flourishing in Aelian, spread themselves through the bestiaries and herbals of the Middle Ages. But Greek literature preserved itself from miraculous, magical elements until the later Empire, say after the time of Justinian, when Eastern folk-lore, talismans, amulets, spells, omens, and demons crept in more and more boldly. So heathen magic penetrated into Christianity.

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[1] *Τήρησίν τινα καὶ ἐμπειρίαν ἱστοροῦντι μᾶλλον ἢ λογικὴν μέθοδον ἐκδιδάσκοντι* (x. 110).

[2] About 250 B.C., a pupil of Herophilus. We have to regret our ignorance concerning this considerable person; almost all else we know is that he wrote glosses on his distinguished compatriot before Erotian. The Empirics boasted of an heretical descent from Akron of Agrigentum (fifth century B.C.), an eminent physician contemporary with Empedocles. It is not unlikely that the tenets of the Sicilian School may have promoted the mystic side of such a reaction, but we have no evidence of it.

In conclusion then, difficult as it is to define distinctions between the later Herophileans and Erasistrateans, or even to contrast the persons and doctrines of the two great leaders, it would seem from the course of events, and from Galen's testimony, that, on the whole, Herophilus had more of the utilitarian bent, while Erasistratus was of a more speculative temper ; for Galen accuses him and his followers of scoffing at the clinical school of Hippocrates in a manner which Galen regarded as unmannerly and cavilling. But probably, as I remarked last year, Erasistratus scoffed not so much at Moses as at the Mosaic dogmatics ; while for Herophilus Haeser vindicates some balance of observation and reasoning, some use of theoretical explanations. Celsus, as I have said, while attributing to Erasistratus some measure of the empirical temper, comments again on this point of view that, although basing its practice upon the more manifest of causes—upon the *causas evidentes*—it did not refuse to excogitate those obscure and remote : *causis obscuris omnibus, non a cogitatione artificis, sed ab ipsa arte rejectis.* So Jack Wilkes was never a Wilkite. It would appear notwithstanding that the concentration of Herophilus upon present symptoms—such as the pulse for instance, on immediate or at any rate proximate causes, and, in common with his great contemporary, upon anatomy both normal and morbid, established a pragmatic bent which in the practice of his disciples, if not in his own, led to over-busy interference, to much drugging, and to excess of venesection; while the Erasistrateans, as reflected in their disciple Asclepiades, reasoning upon wider and remoter causes also, and becoming sceptical of therapeutical prowess, pursued a more expectant method. Accordingly Herophilus abode in the four humours while Erasistratus discarded or neglected them, and had besides the hardihood to scoff at theriacs, which may in part explain the antagonism of Galen to the Erasistrateans; still Galen's opinion carries with it more history than this. For if the humoral doctrine involved its disciples in a mess of pharmacy from which the Erasistrateans won their freedom, yet on the other hand was it not this inclination from the juices towards a dynamic or pneumatist conception which gave countenance to that opinion of Praxagoras, supported by Straton, that the arteries contained air or pneuma rather than blood—an error whose momentous consequence we have seen? Unfortunately the Herophilean seed issued at length in the monstrous brood of Roman and medieval pharmacy; though the great man himself were far away from his obsequious descendants. If Galen's quotation that "in the art of healing is the safe keeping of health" may not perhaps signify what we call "Hygiene," yet what grandeur there is in these words quoted from the *Dietetic* of Herophilus by Sextus Empiricus: σοφίαν ἀνεπίδεικτον, καὶ τέχνην ἄδηλον, καὶ ἴσχυν ἀναγώνιστον, καὶ πλοῦτον ἀχρεῖον, καὶ λόγον ἀδύνατον, ὑγιείας ἀπούσης. (Sext. Emp. *Adv. Eth.* 50, 270). ("Without health, wisdom is darkened, art eclipsed, strength disabled, riches worthless, reason impotent.") Herophilus was, we observe, still master of that Pindaric, almost oracular style to which (p. xi) I have already drawn attention in these great ancients; as in Hippocrates, Pindar, and Aeschylus.

What Galen, who, it is true, attacked some of the pathology of Herophilus, did afterwards was to force both empirics and methodists back to study anatomy and experimental physiology, as Alcmaeon, Diocles, and the Alexandrians had done; to scrutinise causation only too meticulously; and to restore and develop the elemento-humoral tradition; while in his physiology he perpetuated some pneumatism under the guises of the psychical soul and of a divine teleology. Thus, while phlegm was interpreted as moist, yellow bile as hot, black bile as earthy, upon these were worked in the three entities of the soul; the animal soul having its primary reception in the pulmonary veins. By this system, or complicated mesh, he dominated the Medicine of East and West until Leonardo, Vesalius, Harvey, and Thomas Willis. Unhappily, as I have said before, his spirit evaporated; his letter only prevailed. A great part of our difficulty in distributing these sources and phases of opinions lies in what was Galen's own misfortune likewise—that, rich as by tradition may have been his physiological and clinical inheritance, he, like ourselves, was deprived of historical sources; we have seen that even in his day the destruction of manuscripts—as, for one instance, in the siege of Alexandria by Caesar—had been already disastrous. Not only in the time of Galen, and probably of Celsus also,[1] had the works of Erasistratus perished, but still more unhappily certain histories of medicine under the names of Hermippus of Smyrna (*Περὶ ἐνδόξων ἰατρῶν*), Andreas of Carystus, and of Histomachus were also lost (Haeser). Notwithstanding, no insubstantial deliverance of medical tradition if in a more impalpable form than of parchment, was handed down to the third century, through Asclepiades, Themison, Archigenes, and many others over whom oblivion has cast her poppy;[2] and above all the Hippocratic collection of treatises had been preserved.[3]

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[1] Varro, when he was writing the *De R. R.* seems to have had fifty Greek books on Agriculture before him. See also on Libraries, p. 69.

[2] The reader will remember that the treatise of Celsus was either little known to the physicians of Rome in later generations, or was disregarded by them as the compilation of a layman (see p. 203).

[3] As on Aristotle and Plato in philosophy, so in medicine transcripts and commentaries on "Hippocrates" formed the backbone of the tradition. Cicero refers to the writings of Hippocrates as well known. Galen, besides his other reverential services to the father of medicine, wrote, or proposed to write, a critical essay on the genuine and false treatises of the collection. More than one "Corpus" had grown up with somewhat various contents. If that essay was ever completed it is lost; but Mewaldt, in a paper in *Hermes* (1909), discusses some relics of it. The greater Empirics, such as Xeuxis and Heraclides of Tarentum, were loyally devoted to the great master. In the reign of Hadrian one Dioscorides—not the Anazarban—prepared an edition of Hippocrates which had some vogue; but he was accused by Galen of tampering with the text. Other editors of Hippocrates under the Empire are mentioned (*e.g.* Galen, *Comm. Hip. de N. Hom.* and other places). And the prevailing view now seems to be also that Homer was preserved fairly complete from pre-Pisistratean ages.

The brilliant progress of Alexandrian anatomy, human and comparative, *e.g.* the contrast of the surfaces of the brains of man and animals, would in itself suggest that in morbid anatomy also advance was not wanting; although, in the early destruction of the records, and under the overgrowth of the later metaphysical cobwebs, much of it fell into oblivion. But, as we have seen, it is well known that necropsies had been made for the investigation of disease. For instance, statements of Erasistratus have survived that in some cases of dropsy the liver is condensed, and as hard as a stone;[1] that in snake-bite the liver, bladder, and colon are palsied, and that an empyema may form in various cavities of the body. We know that from the time of Hippocrates auscultation was practised on the chest, and percussion for the detection of dropsies; though apparently not for the mapping out of liver or spleen. In Alexandria human pathological necropsies were probably obtained without difficulty; in Rome the current prejudice against them was prohibitive, and it persisted even into the fifteenth century, when the Florentine, Antony Benivieni —the friend of Ficino and Poliziano—made it yield to his ardent importunities.

In coming now to discuss *the later sects*, in some of which anatomy was repudiated as otiose, we shall have to bear in mind that Daremberg, rather against the impression given us by Galen, was of opinion that up to the time of Asclepiades the school of Erasistratus had prevailed over that of Herophilus, and I am disposed to agree with him: at any rate the Erasistratids seem to have been commonly accepted as the "progressives" and the Herophilids as conservatives; a point, as we shall see, of no little importance. In the first century B.C., in Asia Minor, the school of Erasistratus had a second bloom. During the life of Asclepiades some of the disciples of Erasistratus founded a medical school at Smyrna; and, whether it be true or not that Asclepiades studied in Alexandria, a city which, in spite of the decay of its political importance on the shift of the centre of political gravity to Rome, was still a seat of cosmopolitan learning—a hive of Romans, Greeks, and Jews—we do know that his medical studies were begun in Ionia, where in his time were the great cities and great medical schools of which I have spoken. It is curious to perceive how in Asclepiades the old Italian medicine of Magna Graecia was thus carried through Ionia back to Italy.

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[1] See Caelius Aurel. *Chr. Dis.* iii. S. 111.

The great time of Alexandria however was not very long. In consequence of intrigues and persecutions in the later Ptolemaic period of Alexandria many philosophers, physicians, and men of science were exiled, or left the city. We have seen that certain of these emigrants settled in Asia Minor, and founded or developed the filial schools, medical and other, in Ionia and Syria; as for instance at Laodicea, Smyrna, and so forth. From the earlier of these schools issued many eminent physicians; among them Alexander Philalethes, and Cleophantus, one of the masters of Asclepiades and a link between Alexandria and Rome (p. 156). Cleophantus is mentioned by Pliny himself (*N.H.* xxvi. 8) as recommending wine as a medicine; an ancient remedy adopted by Asclepiades also, and imputed to him for unrighteousness. From the school of Laodicea came the oculist Demosthenes Philalethes of Marseilles, the most eminent oculist of antiquity, whose renown was still great in the Middle Ages. Gerbert took his ophthalmology from Demosthenes and established it at Chartres (the oldest medical school in the West) in A.D. 999–1003; and afterwards at Rheims, a daughter school of Chartres. Demosthenes flourished in the first half of the first century A.D.; his work was the source of the Seventh Book of Aetius, and the *Ophthalmicus* of Vindicianus is a latin rendering of Demosthenes. Most of the later treatises on the eye were taken from Oribasius, who in his turn had extracted his materials from Demosthenes. Wellmann speaks of a manuscript at Bobbio which was used by Silvester II. (Gerbert);[1] as recorded in his 130th epistle. But I should add that the identifications of several physicians named Demosthenes are by no means clear. The school of Laodicea was founded by followers of Herophilus, so that Themison the Methodist cannot have been deeply imbued with the doctrines of his birthplace; that of Smyrna, founded by Hikesius[2] about 70 B.C., in the lifetime of Asclepiades one of the earliest and ablest of the Greek physicians in Rome, was, as I have said, Erasistratean, so that the principles of both these leaders were then flourishing; and they continued to flourish for two centuries after our era. Now we have seen that, after his master Chrysippus of Cnidus, Erasistratus vigorously opposed the abuses of venesections, of purgation, and of emetics and clysters—Cnidian mitigations which in Asclepiades of Rome Pliny wrathfully denounced as cajoleries; for how in the face of a disease with horns and hoofs could any honest physician dare to stand prating about "Cito, tuto, et jucunde"!—the well-known formula of Asclepiades. Again, Erasistratus laid much stress upon diet, regimen, and exercises; and he originated that initial abstinence at the commencement of a cure which Asclepiades, and after him the Methodists, made so much of, and which Galen himself approved. The disciples of Herophilus, on the other hand, as we note also in Galen, were more addicted to venesection, and to a profusion of drugs. However, if Herophilus seems to have been a somewhat severe practitioner, still he retained the Hippocratic reliance on clinical observation, and was the first physician to count the pulse—it is said by a water-tube clock [1]—and to describe its characters and changes with a refinement even excessive (p. 301).

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[1] See Haeser; also Wellmann, *Hermes*, 1903, xxxviii. 5. 546-66.

[2] Hikesius wrote a book on diet and drugs which had a considerable vogue, and took a place in the pharmaceutical tradition of Sextius Niger, Pliny, etc., see p. 369.

By considerations such as these we are led on to the subject of the ancient medical sects which took their rise in Alexandria (pp. 301 and 312), and are critically interpreted by Celsus.

THE SCEPTICS.—"*Le doute illimité*" as opposed to "*le doute méthodique*" is a manner of thinking which subtly influences ideas as they emerge from myth and convention; and is indeed one weapon of intellectual enfranchisement: but, as Mr. Bevan says, it breaks down before the exigencies of life.[2] Man is not only a spectator of life but also a maker of it; and for initiative, for making good, the sceptic is tepid and dilatory; impulse is checked in him by fastidiousness and cavilling. Without a vision man will not work long nor well; still visions are imperfect, or they would be realities; by nature they are unsubstantial; their values often lie in imponderables which, for the unimaginative man, are also invisibles. Doctrine, dogma, give at least some crude guidance for action. Thus, by scepticism, not vision only but practice also fall into indifference; things lose their fixed attributes; it is and it isn't; if anything exists it cannot be known, or if known cannot be communicated; there is no objective truth, and so on. Thus the consistent sceptic—on the principles of Gorgias let us say—declines to draw any conclusions whatever (*ἀρρεξία*).[1] He is sceptical of his own scepticism. He would not even assert that the truth behind phenomena is unknowable—for him an awkward dilemma. As Sextus Empiricus remarks—scepticism may be compared with a drug which removes itself as well as other substances from the body.

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[1] See Schöne, H. Markellinos Περὶ ὀφυγμῶν in a *Festschrift* published Basel, 1907, which I lighted upon by chance. Marcellinus, about second century A.D., is a new name in medical history. In all our books on the subject this pulse measurement has been attributed first to Nicolas of Cusa.

[2] See Hicks, Introd. to ed. Aristotle *De anima*; Bevan, *Stoics and Sceptics*, 1917; and Jowett on Aenesidemus, in Smith's *Dict.*

Thus, as in the fifth century B.C. the rise of science began to eat into old religion and custom, Socrates fell back on ethics and humanity, as offering a nearer and more practicable field; and so, as the flux of Heraclitus became utter lability, Pyrrhon and Protagoras arose; and in later Alexandria scepticism made much way, and gathered into a school, the influence of which in Rome extended over the first two centuries of our era, and deeply influenced the Empirical sect of Medicine. Thus again we see how Medicine has depended on the philosophy of the day.

Our chief authority for these phases of thought are the works of Sextus Empiricus, very readable books, which date from the later second century. Aenesidemus of Cnossus, who lived just after Cicero, was apparently the chief mediator between the later Ionian philosophers, the Alexandrians, and the Roman Greeks. But we must not suppose that all the Empirics, or all the Sceptics, were drowned in Pyrrhonism; most of them went no farther than to ignore all transcendental fields of knowledge, all beyond the relations of phenomena to the senses, all theoretical backgrounds. Thus of course they discarded the Ionian molecular and pneumatic theories. Arcesilaus, it is true, was no more than reasonable and discreet when he said that wise men "never believe heavily"; still even this habit of mind is somewhat damping to a fervid temperament, whether of philosopher, scientist, or reformer; and, if more than a wholesome chastening of enthusiasm, is the note of a weary age. For, so to speak, the pioneer of knowledge must work more or less on credit.

Thus it was, as the spirit evaporated from the Medicine of

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[1] See remarks on Xenophanes, p. 89.

Alexandria, leaving behind it set precepts and formulas, there, as under like circumstances elsewhere, a reaction set in which, by a contrary extravagance, ended in a like sterility. Scepticism was always a quality of the moderating Greek spirit; we need not seek its origin in a Protagoras or a Pyrrhon. In part indeed it was a sense of this quality that made the Athenians fear Socrates; a fear lest his dialectic should corrode the steadier conventions of creed and conduct. Even Aristotle, as Benn remarked, assumed that in knowledge we must start from somewhere—from some first principles; he did not foresee that modern science would prove the idleness even of this moderate assumption, of the imposition of any limits on the function of analysis or the fluidity of premises. It was impossible however for the Greek scepticism to penetrate very deeply below the surface; to quote Benn[1] again, before the time of Hume it could hardly have been realised that phenomena cannot be thought of at all except in relation to one another, and that scientific knowledge means a recognition of these interrelations. Still if Sextus Empiricus did not, could not, quite reach Hume's point of view, we have seen that he got very near to it, and that, as Zeller points out, after the first century A.D. in Alexandria, in opposition to the later Academy, a reaction did take place toward an analytic and more methodic scepticism; a reaction only apparently towards Gorgias and Protagoras, really of a more valid nature, setting limits to arbitrary premises and hypotheses and pointing out the difficulty and often the impossibility, at any rate in biology, of repeating the precise conditions of observation, or even of experiment.

In Medicine scepticism became perhaps rather an influence than a school; and thus entered into alliance with empiricism and eclecticism; and so, with the Methodists and Dogmatists, made up the Greco-Roman schools before Pneumatism—say down to Celsus. In clinical practice scepticism reinforced the empirical attitude, as opposed to speculative views and to deductions from abstract principles. It started from the axiom of the incomprehensibility of nature (ἀκαταληψία). The more thoughtful medical empirics, such as Menodotus, did not indeed insist on an inherent opposition between observation and reasoning, between facts and explanations, between mind and experience. Thus Menodotus (first century A.D.) who, so far as it appears, was at least as much philosopher as physician, has been regarded not without reason as a forerunner of Bacon and Mill.[1] At a later date therefore the compound title of sceptic-empirics was given to a fusion of these two bents, as in Sextus Empiricus himself.

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[1] See Benn, *Greek Phil.* ii. 189 ,etc.

THE EMPIRICS.—Mr. Bevan (*loc. cit.*) has pointed out that in the period just before our era Greek philosophy had shown a strong tendency to coalescence, to eclecticism and syncretism; men were seeking a common ground for life, and growing impatient of sectarianism; as they are doing to-day. It was in the later part of the third century, or a little earlier, in Alexandria, under the influence of Philinus of Cos (*c.* 280 B.C.), a pupil of Herophilus, and in the next generation of Serapion, that the sect of the Empirics formally arose, a sect which flourished in Rome and elsewhere really down to the Middle Ages; the bulk of these sectaries I have called in a former essay the philistines of Medicine. Like our own philistines, these physicians were not without excuse, and were guided by a crude and rather barren sort of common sense.

In discussing the history of schisms and sects we must endeavour not to accentuate the differences by logical oppositions, but to perceive the modes and impulses that drove men apart, and what they really had in common. Men rarely separate for fantastic or empty reasons, nor even on mere divergencies of temperament; they secede because certain relatively enlightened minds begin to apprehend the hollowness or inadequacy of current tenets. They secede and carry others with them; the established party is wroth, the dissenters hit back, and in the fury of disputes and repartees the points of difference are forced into exorbitant contrasts. While in calmer moments no sensible dogmatist would have admitted that he treated his patients on an abstract formalism, so no sensible empiric would have admitted that he treated them on detached phenomena, without any attempt to attach fact to fact, or to interpret their directions; or, as Dr. Fielding Garrison puts it, "that they only listed symptoms, without co-ordinating them." Yet in these dissensions of Alexandria the dogmatist was represented as recognising no facts, the empiric no reasons. Some such extremists of course there may have been; some did, it is true, so far flout Anaxagoras and creative reason as boldly to deny to reason any efficient part in natural philosophy, to deny that mind contributed anything to a fabric of knowledge, if indeed fabric it were. Facts to them were as pebbles having no bonds of connexion; so that by reason no faculty of prevision could, according to them, be obtained: nor could experience take any shape. Yet Aristotle, had they listened to him, for the first time in philosophy had taught his pupils that scientific method consisted in collecting facts first, and next in drawing and formulating the inferences. "For to discuss causes when the investigation is complete is the proper and natural method, and that whereby the subjects and premises of an argument will afterwards be made plain."[1] The truth is we can no more separate facts from reason than substance from shadow.

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[1] See Favier, *Un Médecin grec du IIième siècle A.D.*, Thèse de Paris, 1906. Dr. Jackson has referred me to this distinction in Aristotle (*Metaph.* A compared with Book ii. of *Post. Analytica*), that *empiria* recognises that a certain remedy is good for *particular persons*—Callias, Socrates, etc.—when they have a certain fever; *art* recognises the common characteristic of the particular persons; namely that they are phlegmatic, or bilious, etc. As we say nowadays, "treat the patient, not the disease."

Empiricism has, notwithstanding, been a valuable discipline, a more valuable discipline than scepticism, because it bases itself on action, while the sceptic almost inevitably draws aloof from action. Celsus did not lose sight of these considerations of historical justice, but Galen accused the empirics less fairly. From Celsus we gather that the empiric of that day relied on three methods; on chance observations of happy results, but also on deliberate experiments or trials, and on systematic collection of facts. In respect of Medicine Celsus himself admitted it was an *ars conjecturalis*, one in which we cannot get beyond probabilities (τὸ πιθανόν); yet from Menodotus we learn that the empiric did accept what he called an ἐπιλογισμός—which I might translate as "common sense": for instance, we read that in a case of disease of the brain signs or records of any former injury to the head should be sought for, and weighed, even if outside direct perception. Still in his mistrust of tentative hypothesis the empiric remained an extreme Baconian; he believed in induction, but did not apprehend the inductive method in its completeness; he tried to restrict himself as narrowly as possible to proximate causes, and to regard longer concatenations and remoter causes with more than suspicion. The chief fault of the empiric was that he was unaware of the fallacy of *enumeratio simplex*; he had no criterions; even in treatment he would be guided only by the uppermost signs. Obviously then he would vilipend the only anatomy he could know; as Sydenham eschewed pathology. I have surmised indeed that even the anatomy of Alexandria was not developed so far as to give much practical aid to medicine, except in some considerable confirmations of surgery. As the extremer Empiric regarded all nature as impenetrable, too profound, complex, and obscure for comprehension (*ἀκαταληψία*), so it was that he drifted towards Scepticism, a school that was also the resort of disillusioned dogmatists, the sort of persons who cannot be content with provisional and approximate solutions. It is a remarkable tradition concerning Herophilus, that this brilliant anatomist did divide his science from his clinical practice, thus leaning towards the empirics; and the teaching of Erasistratus tended in the same direction; thus in later times revolts have been made to clinical observation from inchoate pathology and pharmacology. Soranus indeed said that necropsies were useless—"*ἀνατομὴ* (that is, *post-mortem* examinations) *ἀχρηστός ἐστιν*." And verily in the midst of later Alexandrian visions many of the sayings of the empirics were refreshing; such as these, quoted by Celsus, "Ne agricolam quidem aut gubernatorem disputatione sed usu fieri"; "Morbos non eloquentia sed remediis sanari"; and the characteristic "Non interesse quid morbum faciat sed quid tollat." The empiric at worst meant business. We can readily understand the testimony of Celsus and others that Empiricism turned out excellent surgeons, such as Heracleides of Tarentum. And they were no transitory sect; we read of professed empirics down to the time of our chief authority, the half empiric and half sceptic Sextus Empiricus in the fifth century, of whose value to us as a historian we are aware. Plausible understudy as he was, he happened upon a long reputation and influence, and became the forerunner of greater men than himself; in the seventeenth century of Montaigne, Charron, and ultimately even of Hume. Formally the Empirics, or, in the second century and onwards, the Sceptico-empirics, in dealing with the five heads of the Dogmatists:

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[1] Arist. *Hist. an.* lib. i. c. 6, Professor D'Arcy Thompson's translation.

(1) Physiology, (2) Aetiology, (3) Hygiene, (4) Semiotic, (5) Therapeutics (to which the Pneumatists added, (6) Pathology—τὸ παθογνωμικόν), reduced them to the fourth and fifth only. Hygiene they thrust into these; surgery and pharmacy they included in Therapeutics. In later Greek times, and even before them, we find that the medical like other sceptics, as they lost their zeal, began to crave for coarse mental stimulants, so that some indeed gave themselves over to rank superstitions.

Still, as I have said, the more rational empirics — the Impressionist School as we may call them—undoubtedly put symptoms in some sort of major and minor subordination, and they held the clinical descriptions of Hippocrates and his immediate followers in esteem. Even as physicians they could not ignore the memory of experiences, nor assert that observation can proceed without connotation; though, in principle, to the ἔνδειξις of the dogmatist they opposed τήρησις. Castelli renders ἔνδειξις as the determination of agents by the causes and mode of generation, *indicati ex indicante*; and τήρησις as *cognitio fide sensuum*; or, as I may put it, a tight attachment of the perception to the mere events. On this habit Galen, in his treatise on Sects, rightly comments that, as phenomena are infinite, we cannot but select; we cannot but note one feature and discard another—for example, that a patient has naturally curly hair or a hammer toe may be irrelevant; and, as it is not every man who knows what to accept and what to discard, therefore discerning observation and collection of the facts anterior to those present (ἱστορία) imply training. Moreover the profounder affinities cannot be detected but by reason. Here lies, again, the perennial quarrel between the practical man and the theorist; the theorist is prone to overlook the complexities and contingencies of practice, the practical man to see nothing but these. However, even early and rude empiricism could not but begin to demand explanations, and to perceive that there were things ἄδηλα (latent), as well as φανερά (manifest), with which, if true affinities are to be traced out, the understanding must deal. One fact was not as good as another; facts had their relative values, to be appreciated by a mental operation; some indeed were crucial. But, persisted the empiric, clinical observation cannot teach us causes, while shrewdness and insight with experience—*πεῖρα τριβική*—can by provisional axioms make order enough to give the physician no insufficient guidance in the infinite world of symptoms. It was by isolating his method that the empiric starved it. Still, with these and such limitations, it would seem that the empiric, as such, could never have risen even to the bare idea of preventive medicine. And if we reflect upon medical history we shall perceive that by a true instinct the abler physicians of all sects and ages did nevertheless take account of remoter causes; *e.g.* of the "non-naturals" such as habits, climate, social circumstances and so on. The empiric did not see that the human mind cannot, or will not, content itself with perpetual suspense, but must construct; or that in default of some chain of reason it will betake itself to analogies, which are usually superficial and false. Nor did he perceive the indirect influence of reasoning in training the mind, as an instrument, to accuracy and method. Serapion (*c.* 220 B.C.) indeed explicitly advocated analogy—*ἡ ἀπὸ τοῦ ὁμοίου μετάβασις*—a method fraught with the gross errors which I have indicated in the history of folk-medicine. It was probably Serapion who started that wildest of all "theories"—the wanderings of the uterus.

A debased empiricism will then abut either, on the one hand by recognition only of the coarser phenomena, upon folk-medicine, or on the other, as in Sextus, upon the scepticism of fatigue; but more enlightened empirics, such as Menodotus, almost attained the salvation of the inductive method, and definitely did take account of remoter and deeper causes. I have said that Menodotus, as M. Favier in his able essay (p. 166 *n.*) has shown, seems to have recognised the value and purpose of provisional hypothesis. However their tendency to scepticism is indicated by such terms, common to both empirics and sceptics, as *ἐγκύρησις*—a lighting upon events, as opposed to conceptual anticipation or recognition of them.

When we try now to compare the standpoint of the *Dogmatist* with that of the empiric, we are met on the threshold with the curious question, How much in the direction of the understanding the senses contain, or imply; and how much *διάνοια*—or the intelligent collection of apparent facts, contains of *λογισμός*—or a reconstruction of them; and again, how far these processes are functionally in combination with *ἱστορία* or anamnesis?

On reflection we shall perceive that only in an abstract logical scheme, in a sort of "Athanasian" mosaic, is the mind divisible into such severalties. The faculties of mind and body work not in compartments but as a contexture; and in so far as these faculties are drawn asunder the functions of the whole understanding are thrown out of balance, and its products perverted. In the school of Hippocrates it is true that the humoral hypothesis was professed; yet in the matter of practice the bent of it was strongly empirical, and the understanding regarded as receptive rather than productive. It was to this attitude of mind that Sydenham returned, to a sort of systematic empiricism making for the plotting out of phenomena in series, in some contrast with the comparatively occult curiosity of Morgagni about seats of disease, and of modern medicine about their genesis. And if the mere empiric lacked breadth and depth of view, yet he made a better practitioner than the merely book-learned; he had a better eye for contingencies and individualities. This Celsus could not but see: "*Itaque ista quoque naturae contemplatio quamvis non faciat medicum, aptiorem tamen medicinae reddit*" (viii. 29). Unfortunately at the same time no man is more prone than the empiric to act on conventional hypotheses, to declare and to act upon current universals which would make the scientist stare. Hence in mental training the value of the blend with the sceptics. Carneades, the founder of the New Academy, emphasised the importance of negative instances, and of the services of an expert for careful analysis and distinction of contingent conditions. Broadly speaking it was indeed in this reliance on sagacity before logic, that the more open-minded dogmatists—such as Celsus—were Hippocratean; they trained and trusted the faculty which Cicero called *ingenium sagax.* And, after all, perhaps few schools—as few religions—were as bad as their creeds. To quote Celsus again: *quae maxime ex utraque parte dicantur quo facilius nostra quoque opinio interponi possit*; and (in another place) *ea neque addicta opinioni sunt ne ab utraque nimium abhorrentia media, quodammodo inter diversas sententias* (wherein appears our old friend, abhorred of Newman, the "via media" man). Empirics and Dogmatists then, as we should suppose, were most conversant with symptoms, pharmacy, and surgical operations. Through them the stream of tradition ran strongest in these subjects; they insisted upon a close, if too often superficial and undiscerning, record of symptoms; they compiled a vast array of drugs, nostrums, and recipes perennially copied from hand to hand, under the fog of which true therapeutics were slowly suffocated.

On the *Iatrosophists*, the degenerate descendants of these schools, in the later Empire, and their empty, hair-splitting dialectic, it is not needful for me to waste your time and attention; nor with the many popular medical books and recipe lists, réchauffés of older literature with magical additions—incantations, sympathetic spells, etc. As one historian says, "We may be content to pity their poor patients."

Of the resulting state of all this medical opinion in Rome in the first century B.C. we have but indirect evidence, and of this not much. Moreover, we have to sift the random invectives of Pliny; though happily we are often able to discard them for the evidence of the sober and competent Celsus, who, moreover, flourished nearer to the time we are considering—the time, that is, of the setting of the school of Alexandria and of the large migration of medicine to Rome. In the treatise of Celsus Medicine in Rome is thus presented to us as still in its main quality Hippocratic; but fortified by Alexandrian science, and chastened by the influence of the empirics who were protesting against later Hellenistic vagaries in Oriental metaphysics. Of Celsus himself I will speak presently (Chap. VIII.); here I must be content to repeat that in the Introduction to his treatise we have a masterly summary of the lost records of Alexandrian medicine. Among the upper classes of Rome in the first century A.D., Medicine had been lifted far above the folk-medicine of Cato, which however beneath these classes was flowing on in scarcely diminished volume. Then, floating upon a Graeco-Roman aristocracy of family and wealth was a Greek, but still, as represented by their spokesman Celsus, a sedate and instructed Medicine qualified by the Roman gravity, when, from more than one quarter, burst forth a new and revolutionary idea, championed by men of great ability, by a poet of transcendent genius, and by a physician rich in talents, which shook the Hippocratean raft almost to pieces. Indeed, in its later and corrupted form it was dissipating the science and art of medicine into empty conceits, when the more tremendous and, on the whole, more virtuous arm of Galen attacked and demolished it. Then, as in the third century B.C. and again in the thirteenth, sixteenth, and nineteenth A.D., medicine was saved by surgery and anatomy.[1]

So close have been the alliances between medicine and philosophy one may wonder that the atomism of the unrivalled twin masters Democritus and Leucippus had not made an earlier prize of our art—an art drifting then and since through many ages with uncharted methods, and without anchorages in substantial knowledge; for humoralism had ignored, or neglected the pathology of the solids of the body. Leucippus and Democritus, to explain the origin of quality from homogeneous elementary particles, conceived the theory of impenetrable atoms vibrating *inter se* (p. 105); and therewith had to assume spaces in which the particles could move in infinite variety of form, order, and position. Now it is true that, brilliant and prophetic as was the atomic hypothesis, it made in that day a very fantastic basis for the art of medicine. Still when Aristotle said, truly enough, that cold condenses (*πυκνοῖ*) and heat makes more permeable (*μανότερον*), we see a hovering about the edges of Methodism and apprehend how and where these outgrowths of doctrine branched away from each other. The triumph of Methodism proved, it is true, to be but a hollow and transitory show; though, as I have stated upon the elucidations of Daremberg, Diels, and Wellmann, its survival, from its beginning to its fading away in Salerno, was a longer story than is usually told. Doctrines have their roots deeper in the past, and their vitality lingers longer, than is obvious to the cursory observer.

The Hippocratic Canon is permeated by many inconsistent strains of thought; as, for example, in the *Περὶ διαίτης*; the *Περὶ φύσιος ἀνθρώπου*; the *Περὶ φυσῶν*, etc., books which betray the influence of Sicilian, Ionic, and sophistical doctrines (see p. 213). Again, Diocles seems to have been a forerunner of the pneumatists. So during the adumbrations of Methodism we find that Asclepiades, fair anatomist as he probably was, apparently held the strange opinion, excusably derided by Galen,[2] that the urine was not as Hippocrates (*Περὶ ὀστέων φύσιος*) truly held, a stream secreted by the kidneys and trickling as rivulets by way of the ureters into the reservoir of the bladder, but an exhalation from the corporeal fluids rising in vapour which vaguely permeated the pores of the body, and condensed in the bladder.[1] Now it luckily happens that Galen, in contesting this very unanatomical but very methodistical notion, reminds us that it was in origin pre-Alexandrian. Furthermore, certain opinions concerning plethora, similar to those of Asclepiades, were also held, before Erasistratus, by Aegimius of Elis. Now Aegimius, as we are told by Celsus and Galen, did not accept the humoral pathology, and was therefore in doctrine neither Coan nor Cnidian. In pre-Alexandrian times Aegimius may have been the first champion of atomism in medicine, as Asclepiades was, strictly speaking, the last. These and such questions are very ably treated by Wellmann in the new Pauly, where he traces back the atomistic stage of medical history to Erasistratus, and beyond him; and finds the influence of Aegimius in the *Anon. of London* (p. 241).[2] Diels is now of opinion that Erasistratus endeavoured to harmonise the "materialism" of Democritus with the ideas of Aristotle; that, according to Erasistratus, it was by an atomic mechanism that the great artist Nature designed and created; as Galen put it (*De facult. nat.* ii. 2, etc.), "*προνοητικὴν τοῦ ζώου καὶ τεχνικὴν αὐτὸς ὁ Ἐρασίστρατος ὑπέθετο τὴν φύσιν*" ("E. taught that nature was the designer and creator of living things"). Health accordingly consisted in a *συμμετρία* (rhythmical system) of these rudiments.

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[1] See my *Historical Relations of Medicine and Surgery*, 1905.

[2] "Nature" is a defective translation for *physis*, as used by these thinkers. Perhaps inspiration is the best english available for many contexts. But it is a chameleonic word. The distinction between *physis* and *technē* is a very early one.

The atomic theory, as we have seen (p. 105), was held in contrast not only to the infinite divisibility of matter, but also to the continuity of matter—to the doctrine of the Eleatics who held, as we know (p. 119), that matter was a plenum, and motion in it as of a fish in water which "makes its own room by leaving it behind"; but also to the doctrine of *homoeomeria* (p. 108), or the pre-existence and supply for growth and nutrition of minute formed elements; *e.g.* of bony particles for bone nutrition, of fibre for fibres, of blood for blood, and so on. In the words of Lucretius (i. 830 and *seq.*) "Ossa videlicet e pauxillis atque minutis ossibus hic et de pauxillis atque minutis visceribus viscus gigni, etc. etc.," and so on: what theologians have called a "portmanteau hypothesis."

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[1] In Plato, *Tim.* we find some such notion.

[2] See also Diels, *Neuer Jahres-Bl. f. d. klass. Alt.*, 1908, vol. xxi.

Of the Methodists and the Pneumatists, sects which took definite form under the Empire, we can speak more fully and conveniently a little later. So far we are to see that Erasistratus and Asclepiades were two cardinal leaders in the history of Medicine.

CHAPTER VI

SETTLEMENT OF GREEK PHYSICIANS IN ROME

SUCH then were the manifold doxies spun by Greek ingenuity out of their scanty staple of the medical sciences. Yet in the midst of these dialectics there were for the wiser Greek physician three factors of safety: he was free from magic; he was a master of hygiene; and, whatever his abstract notions, he never forgot to treat the individual. But, as Coleridge said of Greek literature, so of Greek medicine; in Rome it was "a superfetation upon, not an ingredient in, the national character."[1]

The first physicians to wend their way to Rome were of those whom we know to have been employed about the gymnasiums and the arena. But on the common knowledge of the standard histories, the *trita scholarum*, I will forbear to dwell. The first Greek doctors were slaves, those clever menials whose adroitness was mistrusted by the old Roman. But in the third century freemen also were beginning to find their way to Rome, and thereafter the edict of Julius, giving discretion to governors to confer citizenship on physicians, though based on the needs of the Army, encouraged a higher class of them to settle in civil life; not in Rome only but also in other larger cities of the Empire, such as Marseilles. From that time they had a definite status.

Archagathus arrived in Rome from the Peloponnesus about 220 B.C., some twenty years after the Punic War for the cornlands of Sicily. He was one of the first to feel the brunt of Roman indignation at the blasphemy of mistrusting the protecting gods, and the impiety of supplanting the tried resources of the Penates. Was it this prejudice only which turned his title of "Vulnerarius" into that of "Carnifex"? Was he so barbarous a surgeon, or was this story only Pliny's fun? For, on the other hand, he certainly was accepted as a Roman citizen, and a *taberna* was assigned to him, at the State expense, in the city near the Forum Marcelli. Whether or not he was subsidised as a public physician—δημοσιεύων—after the Greek fashion (p. 446), is an interesting question; for if so, as we shall see later, this office must in Rome itself, though not in the provinces, have fallen soon into desuetude.

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[1] Latin medical books, *e.g.* Theodore Priscian, C. Aurelianus, Vindicianus, etc., in the fourth to fifth century were, as we shall see, mostly translations.

Passing from Archagathus over obscure names and traces, I would concentrate our attention, in respect of the first effective invasion of Rome by Greek medicine, upon the greater name of *Asclepiades*, whom I have mentioned more than once. It is one of the flouts of time that the reputation of this great physician had fallen, not only into neglect, but even into obloquy; and, after the lapse of nearly two thousand years, the belated duty of restoring his name and place to their merited honour has been reserved for our own times. I say after nearly two thousand years, because although Asclepiades was born somewhere between 131 and 124 years before Christ, he first practised in Parion, a Mysian town on the Hellespont; then in Athens; and did not go to Rome till 91 B.C. He died in extreme old age (Pliny).[1] At thirty years of age he was famous, and his fame suffered not eclipse until the star of Galen arose; then the torch of Asclepiades was quenched. His works, scarce in the fourth century, in the sixth were lost; so that his reputation was at the mercy of any scribbler whose gossip or malice was thus placed beyond direct confutation. Something like the same neglect befell Celsus, whose treatise on medicine was also lost sight of until the fifteenth century.

It may be that this earthly orb, when it judges, judges securely; but it takes an unconscionable time to consider its judgements, and too often meanwhile this loss of documents arrests the course of its justice. Six hundred years ago, when the path of secular knowledge was the path to persecution or the stake, flourished, or tried to flourish, Roger Bacon, the friend of Grossetête and Adam Marsh, one of the most masterly spirits of any time or people, and one of the boldest and most unfortunate champions of the emancipation of the human mind. And behind him stood the august shade of Peter of Maricourt, silent for ever and unknown. Yet but the other day the historical school of his own university knew no better than to represent Bacon publicly as a buffoon.[1] So much for modern humanism. And if this be true of modern history, what may we expect concerning the submerged scientific geniuses of two thousand years ago! Now I will not compare the memorable talents of Asclepiades, whose reputation for something like this interval has been under eclipse, with the genius of Bacon; nor the career of that favourite of kings and harvester of fees with the bitter bread of Bacon's captivity and the ironical denial of the eloquence of the pen to that bountiful and unconquerable mind; yet, had Asclepiades been even a smaller man than in fact he was, for the sake of historical truth no inconsiderable measure of vindication would still have been his due.

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[1] See Wellmann, *N. Jahres-Bt. f. d. klass Alt.* Bd. xxii.-xxiii. H. 10, S. 684.

Asclepiades may remind us in many respects of Boerhaave. In the one case and the other, affable manners, good fortune, and worldly prosperity threw a vulgar glitter over a career of rich practical and philosophic attainments, versatility of mind and temperament, rapid clinical perception, and sagacious insight into the conditions of health and disease: these were the endowments of both men, and in each of them approached, if they did not quite amount to, original genius. We meet also with the curious coincidence that, in his first dissertation, Boerhaave also occupied himself in part with the atomic philosophy of Epicurus. That in the literature of his age Asclepiades was a widely read man we observe, says Wellmann, even in his opposition to his master Erasistratus recorded in the Ἀντιλογικά (*Contradictoria*) of Caelius Aurelianus (Παρασκευαί and Περὶ ὀξέων παθῶν), and in other criticisms of his predecessors. To Boerhaave ingratiating manners, elegant accomplishments, and popular vogue and fortune became no reproach; but in Asclepiades these qualities have been construed into sycophancy, sophistry, chicanery, and avarice. Asclepiades moreover turned back from Epicurus to Democritus. He declined to set apart any seat for the soul, regarding it as the sum of functions, of the motions of all the particles of the body.

It may be said that Asclepiades lived a long time ago; that his contemporaries knew him better than we can do; or, anyhow, that there is no use in worrying over dead issues and obsolete reputations. From what has gone before however we are prepared to find that Asclepiades, if only as a disciple of Erasistratus and expositor of Alexandrian medicine in Rome, occupies not only a high, but even a cardinal place in the history of medicine. Celsus puts him "inter praecipuos medicorum; si unum Hippocratem excipias, caeteris princeps" (ix. 9), a superb tribute; Scribonius Largus speaks of him as a most distinguished physician. He was invited, more than once, to the court of Mithridates Eupator, invitations which he declined.[1] Broken as are the lights in which for us he stands, yet his is the first figure which stands forth under any illumination since the dispersion or decline of the greater schools of Greece. The illustrious names of Herophilus and Erasistratus were in Rome little more than luminous shadows. Again, in so far as history is, or is to be, a science, or even morally effectual, none of its facts is to be taken offhand at its apparent dimensions. Now the cardinal moment at which Asclepiades flourished was that of a new outpouring of Greek philosophy and medicine into the alien air of Rome. The meaning of his career contains therefore much of the meaning, and of the ideas, of the age in which he lived, and of which he was a type; if then the reports of his contemporaries were coloured by envy or prejudice, our view of the period, and of the course of history is so far perverted. It is our concern to weigh the value of each witness, and to compare the witnesses one with another; remembering in this case that *calumniare audacter, semper aliquid haeret.* Moreover we must not give too much latitude to the word "contemporary." We have seen, it is true, that of ideas and doctrines Asclepiades was rather a carrier than an originator; an ardent disciple of Erasistratus he brought to Rome the teaching of that illustrious physician, and in a still larger sense the science and art of Alexandria. Indeed if we look back to Plato (*Timaeus* 89) we shall find similar therapeutical principles.[2]

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[1] Since this lecture was delivered, as a sort of tacit confession of sin, an attempt has been made to repair this injury; but the injury was public and popular, the repair academic.

Asclepiades was born in Bithynia,[3] about 130–124 B.C., at that interesting city Prusa ; so that he was about a generation older than Lucretius. His name suggests that his family had some connexion with the medical calling, but the name, as we might expect, was no uncommon one ; of his time fourteen persons are known to have borne it. His father was probably one Andreas, a physiologist of note.[1] It is said that the physician, himself an eloquent man—Pliny admits that he was a master of oratory—was often confounded with another Asclepiades, a rhetorician ; whence may have arisen Pliny's spiteful legend that, having found rhetoric unprofitable, Asclepiades had turned to medicine, with a sophist's adroitness and the ignorance of a layman. Now we must remember that if to the elder Romans rhetoric and sophistry were unwelcome, in Greece these accomplishments were held in a repute, and implied qualities, far higher than in our own day. For Asclepiades education in rhetoric and sophistry meant pretty much what would be meant in our day by Classical Honours and reading for the Bar. Dioscorides, for example, was educated first in these studies, probably in Alexandria as well as in Tarsus. At a little later period we read that many students were leaving the schools of rhetoric to study Medicine. Nay moreover, Rome herself, even at this period, was becoming rhetorical ; and from Augustan times onward rhetoric, both sophistic and ornamental, was a well-marked character of Roman life and literature. In those days of select authorship and still rarer reading, speech—*regina rerum oratio*—was the intellectual, actual, and spiritual organ—the logos—of civilisation ; it directed states, formed policies, and animated nations. Thus it was that in the time of Asclepiades the *institutio oratorica* was an integral part of Roman education, and the grace of its higher callings. We are apt to take academic disputations to be only medieval ; yet they did but continue the Greco-Roman traditions.[2] The Rome of Asclepiades was bringing rhetoric into life ; Rome of the Early Empire was steeped in it ; there was not a tea-party without it. Generals harangued their armies, the Senate harangued itself. Even the schoolboys had their declamations. Medical literature was saturated with it.[3]

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[1] Prof. Reid thinks the invitations of Mithridates to Asclepiades must have been before 92 B.C., when the enmity between this potentate and Rome broke out. But Mithridates may not have regarded the Bithynian as a Roman enemy.

[2] *E.g.* "If any one ignorant of the intention of nature would get the better of the complications of disease by medicine, he only increases and multiplies them. Wherefore we ought always to manage them by regimen . . . and not provoke a disagreeable enemy by medicinal treatment"; and so on.

[3] Herophilus and Hipparchus were also Bithynians.

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[1] See Tertull. *De anima*, xv., quoted Wellmann, *loc. cit.*

[2] Arcesilaus introduced the thesis and public disputation into the later Academy. He disputed with the students on the Socratic method ; or would himself argue before them *n either side of the thesis.*

[3] As a good example, see the Περὶ τέχνης ; as a bad one the Περὶ φυσῶν.

Indeed in respect to rhetoric Asclepiades and Galen were pot and kettle.

But, to rectify our definition of a "contemporary," Pliny was born about seventy years after the death of Asclepiades; the prudent Celsus, who probably lived a little earlier, though none too willing a witness, says of him, that "*Medendi rationem ex magna parte mutavit.*" Asclepiades has suffered the more in reputation with modern English scholars as, in my opinion and that of others, Greenhill, the sometime honoured friend of many of us, and in medical history the revered teacher of us all, accepted too readily the irresponsible invective of Pliny, and the current estimate founded upon his testimony and reinforced by certain strictures of Celsus and Galen; strictures animated by controversial strife, not by moral censure. With their doctrinal differences, and the schisms which gave rise to them, I am to deal presently; here I can stay only to insist that the cloud of disputers on the various doctrines of Asclepiades, as witnessed by Celsus and by Galen himself, testify to his eminence in the medicine of the period. After all, when we bear in mind the furious and malignant denunciations of the orators of those days, we may regard those of Galen as tepid. And we must remember that much of what we know of Asclepiades comes, as part of the assault upon his master Erasistratus, through Galen—no achromatic medium; especially as by him the picture was seen through the haze of waning Methodism. Suffice it to repeat now that for Asclepiades medicine was no afterthought; from his youth he was educated for our profession; in Wellmann's opinion he was not only thus educated at Athens, as we now know, but probably at Alexandria also. It was from Athens, where he began practice, that he brought to Rome the theory of medicine founded upon the atomistic philosophy of Democritus, then passing under the name of Epicurus, and soon afterwards to be transfigured in the shining car of Lucretius.

It was thus that, having rejected the humoral theory, Asclepiades, as an atomist, laid the foundations of the Methodist school afterwards formally established by Themison. We have seen that virtually Erasistratus, and probably before him Aegimius of Elis, had already carried the atomic hypothesis into medicine. Epicurus, so far as he was seriously a philosopher, held that the essence of the sóul was a principle of life in combination with air (ἀήρ), pneuma, heat, and a fourth—unnamed—element; air promoted rest, pneuma motion, heat vital activity, and the fourth element the sensory phenomena. But Asclepiades went back to Democritus in regarding "soul" as the ordered motions of all particles of the body, a conception approximating to entelechy, and inconsistent with any particular seat for the soul. The soul, or life, he held, was generated in the respiration, as against the school of Protagoras which held that the soul was not generated thereby but only invigorated. But after all these were but derivative, second-hand, philosophisings.

Concerning the personal character of Asclepiades, as in England the adverse view of his life and doctrine received the sanction of Greenhill, it is from him in the first place that I must curtly present it. In his well-known article in Smith, Greenhill says, "Asclepiades may fairly be characterised as a man of natural talents, acquainted with human nature, or rather with human weakness, possessed of considerable shrewdness and address, but with little science or professional skill. He began (upon the plan which is so generally found successful by those who are conscious of their own ignorance) by vilifying the principles and practice of his predecessors, and by asserting that he had discovered a more compendious and effective mode of treating disease *than had been before known to the world*. [Italics mine.] . . . He directed his attacks more especially against the writings of Hippocrates." Greenhill then goes on to argue that the methods of Asclepiades owed their popularity to his assiduous attention to everything which contributed to the comfort, flattered the prejudices, and indulged the inclinations of the luxurious classes. "We cannot fail," he adds, "to recognise in Asclepiades the prototype of more than one popular physician of modern times." This is pretty scathing; and I suspect the distinguished critic, who was better versed in medicine than in philosophy, was not indisposed to use this parable of Asclepiades for the chastisement of certain professional sinners of his own day. Dr. Withington, who may be said to represent opinion as now prevalent, with a more even verdict but still with an ironical pen, sides, on the whole, with Greenhill. He, too, is not unnaturally angry with Asclepiades for his revolt from Hippocrates. It is only too true that, as I have said, many of the Greek doctors who, with other Greeklings—artistic and other adventurers and parasites, swarmed into Rome to shake the pagoda tree, were slaves and supple rascals, such as Juvenal describes, ready to abet any villainy of their masters; and Asclepiades lived in Rome before that first bestowal of citizenship on certain physicians by Julius, as on Musa under Augustus, on Andromachus and Dioscorides under Nero, on Galen under M. Aurelius, on Oribasius under Julian, and so on; recognitions which had raised the social status of medicine, and the honour of its practitioners. During the last century however there were not a few writers to take a more respectful view of Asclepiades, both as to his virtue and ability. The first scholar to qualify, or rather to awaken, my own interest in Asclepiades was that brilliant friend of my youth, Maurice Raynaud, snatched so prematurely from his friends and from medical science.

At a much later date, some ten or more years ago, a tract by Dr. v. Vilas [1] came into my hands which made a more radical change in my estimate of Asclepiades. It may be true, as Max Wellmann says, that v. Vilas was not sufficiently equipped with recent learning to do full justice to his theme; still Wellmann's standard is a high one, and a pioneer such as v. Vilas may on a humbler scale have deserved very well of us. His points were fresh, he put them well, and supported them with no inconsiderable information. Moreover, he did the reader the service of setting him on the way to discover the earlier literary testimony. M. Albert also, in his *Les Médecins grecs à Rome*, has given a balanced and still better-informed estimate of the place due to Asclepiades; Fuchs (in Pagel), and Neuburger [2] especially, have dwelt more adequately on the evidence for a far different interpretation of his character and talents; yet even these authors realise imperfectly the extravagance, weakness, and bias of the persistent detractions. *Aliquid haerebat.* The last and most convincing vindications of the place of Asclepiades are the history of medical science before his time, and the essay by Wellmann to which I have already referred.

Without claiming then for Asclepiades a measure of magnanimity far beyond the easy standard of the age in which he lived, I repeat that we must remember the gross licence of backbiting and invective then tolerated, nay, even customary, in Rome. Of this licence, as I have said, we see colossal examples in the forensic orations of the time, even in those of men as cultivated and humane as Cicero; and in cases where we have better means of seeing into the well of truth than remain to us in the instance of Asclepiades. In the latter days of Athens and Alexandria Hellenism, settling on its lees, had become more and more artificial and disputatious, more and more charged with schismatic animosities. In those passions of opinion personal reputations were indiscriminately massacred.

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[1] H. von Vilas, "Der Arzt u. Philosoph Asclepiades von Bithynien," *Hist. krit. Studie*, Wien, 1903.

[2] When my FitzPatrick Lectures were delivered I had not seen Neuburger's valuable history, then recently published.

It is narrated of Asclepiades that one day, passing along the street, he saw a body stretched upon a bier, on the way to burial. He interfered, perceived some sign of life in the body, and applied restoratives; the supposed corpse quickened, and the man was made whole. The multitude acclaimed Asclepiades as a god—to the annoyance, no doubt, of rival practitioners. This rather well-worn legend is used in building up the accusations of charlatanry against the too lucky physician. But, even if this old story be correctly told of Asclepiades, we know nothing of the circumstances which led him to intervene, nor do we know how he carried himself under the adulation. What we do know is, that to expose the sick and dying on the highways, for the chance wisdom of the passers-by, was an ancient and familiar custom. Moreover, we know, from Galen himself that Asclepiades, as Herophilus before him, had devoted especial attention to the pulse.

Another, and I think the only other, evidence alleged for the charlatanry, or wily complaisance, of the Greek is that in a time of growing luxury he softened therapeutical methods likewise; that he laid aside coarse and drastic remedies for gentler means—for regimen, baths, diet, exercises, and so forth; and that he introduced these changes in Rome with the manners of Boerhaave and Mead rather than of Radcliffe and Abernethy. His was the phrase "Cito, tuto, et jucunde." The cold baths as prescribed by Asclepiades, Musa, and Agathinus became the fashion in the Empire for three or four generations. But it seems not to have occurred to historians to inquire whether these mitigations of practice, that drew upon him the hostilities and backbitings which mob innovations and innovators, were supple concessions to a voluptuous generation, or were at least consistent with a new and revolutionary doctrine, not his own inventions but a stream from the fountain of Alexandrian thought.

That Asclepiades should have lifted up his voice against the sacred head of Hippocrates has no doubt made all historians, from Celsus to Dr. Withington, righteously indignant; and not without some reason. The leader of the Hippocratean school had seen certain aspects of pathology with the eye of genius; Asclepiades saw another—a smaller side, if you please, but not fictitious. And there is no evidence that his opposition to the humoral pathology, as construed by the Dogmatists, was embittered by personal acrimony; it seems to have been in the form of argument, if of some sarcasm pointed by epigram. It is indeed a little curious that he should have called the Hippocratean expectancy a study upon death (*θανάτου μελέτη*),[1] seeing that his own movement had been from dashing therapeutics to more rational and temperate methods, the methods of Hippocrates; but this very discrepancy seems to mark his polemic as petulant rather than impious. And Galen's arrant teleological convictions were outraged by the flippant quip that Nature was as ready to kill a man as to cure him. Yet in moments of temper have not some of the modernest of us said the same?

As regards rhetoric I have admitted that, as under the Empire books became more abundant and political freedom and initiative waned, so rhetoric, losing its substance, aims, and appeal, became ornate, fanciful, and artificial (p. 180); but in the day of Asclepiades the name of rhetorician had not fallen into disrepute.

Asclepiades was a voluminous author, but little remains of the twenty or more treatises of which the titles are known; a loss the more unfortunate as we learn that in them was contained a large portion of historical record. But more or less of it is embalmed in Celsus, Pliny, Caelius, Dioscorides, Galen, etc. The fragments of Asclepiades, who is quoted by about thirty-three authors in various fields, in which passages again ten more references are embedded, were collected by Gumpert in 1794. Besides the comprehensive excerpt in Oribasius, the chief sources are only four: namely, Celsus, Pliny, Galen, and Caelius Aurelianus: of these Caelius is the most important.

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[1] Mr. Barnard Cook reminds me that this expression might be construed even as a compliment. See Plato, *Phaedo* 80 E *ὀρθῶς φιλοσοφοῦσα καὶ τῷ ὄντι τεθνάναι μελετῶσα . . . ἢ οὐ τοῦτ' ἂν εἴη μελέτη θανάτου;*

Unfortunately, such has been the ill luck of Asclepiades, that for many generations the writings of Caelius Aurelianus were lost, or concealed under corruptions of his name. By the same misfortune, much of our knowledge of Soranus, and of the history of the sect of the Methodists, lay long in obscurity. Thus the writings of one who seems to have been among the clearest thinkers and authors of antiquity have been almost lost to history.

A modern writer on medical history has made the interesting remark that as celestial bodies, while themselves invisible, may in some measure be recognised by their influences upon the paths of the bodies visible, so phases of the past of which, as in the case of Alexandria, the records are lost, may in some measure come into our ken by certain otherwise unaccountable deviations of recorded periods. We must endeavour then to calculate from the orbits of medical thought and practice which we can plot out, those influences upon the men of later times; thus I have to defend the essential importance of the large excursions that I have made into the history of the earlier eras of science. For example, we learn, from Brieger and other commentators, the opinion of Democritus that the soul, in which he included mind and senses, consisted in a collective activity of spiritualised—that is the finest, for, like Heraclitus, he regarded soul-atoms as identical with heat[1]—atoms in all parts of the body. This opinion, with a small difference, was held by Asclepiades also, who founded upon it a positive method of psychiatry, wherein mental derangement (παραφροσύνη), which he clearly distinguished from the cerebral symptoms of other diseases, was notwithstanding to be treated as a disorder of the brain, a corporeal disease remediable by corporeal means, in which music and other psychical influences were included; a true and original conception which may be said to have fallen into utter neglect until its restoration by Pinel (p. 256). A note of the insight of Asclepiades is to be marked in these ideas of the integration of soul and body; for that they were real thoughts of his, not notions coloured to our modern patterns, is illustrated by such reflections as this—that hallucinations dissolve or diminish in the daytime because they are counteracted by the data of the senses; as in the rays of the sun a torch becomes invisible; but in the dark, as the veil of oppression over the senses cannot be drawn away, so in sleep, the senses being closed, the pictures of fancy have free play. (Cf. Lucretius vi. 45.)

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[1] See Hammond, Aristotle, *De anima*, 1902.

It was then to the remarkable opinions of Democritus on the nature of the soul that Asclepiades, surpassing certain shortcomings of later thinkers, including Epicurus himself, returned; he was indeed the last authoritative teacher of the atomistic hypothesis; but now we come to an important advance of his own. Democritus, as I have said, held the fertile opinion that the soul consisted in the sum of functions, in a co-operation of the atoms of all parts of the bodily system (*συγγυμνασία τῶν αἰσθήσεων*), so that between animation, consciousness, and thought—the *ἄλογον* and the *λογιστικόν*—there were for him only degrees, no radical division. Of this great disciple of Leucippus we know (p. 106) that he was addicted to Medicine; that he dissected animals as Alcmaeon had done, that he studied the anatomy of the eye, the physiology of the senses, of the pulse, and of generation, and the pathology of inflammation. He regarded all the senses as modifications of touch. He is said to have attributed rabies to an inflammation of the nerves; and in the extravagance of his suggestion that epidemics were caused by flights of atoms from the heavenly bodies we must not overlook the pregnancy of the idea. Now Erasistratus had accepted the familiar divisions between the vital principle of the viscera, of the animal life in the arteries and respiration (*τὸ ζωτικόν*), and of the mind (*τὸ ψυχικόν*). For Empedocles the soul was in the blood, for Diocles and Praxagoras in the heart. It was the corollary of Epicurus, that for the sake of the soul the body must therefore be cherished, a doctrine which led to the degradations of hedonism.

Now it is recorded of Asclepiades that in this part of physiology he made certain proofs by experiment. The view of Democritus, already mentioned, of the soul as the sum of functions, —*πνεῦμα παντὶ τῷ σώματι παρακείμενον*, obviously excluded a particular seat of the soul as pneuma; yet, said Asclepiades, in the synthesis the brain must take a predominant part; for he had observed diseases of the brain to be followed by notable perversions of the mind. It was to throw light on this dilemma that he undertook experiments, in some anticipation of the methods of Galen; he decapitated animals of different orders—eels, tortoises, goats, crickets, flies—and pointed out that, though under this dismemberment they could all survive a while, yet it was in very various degrees. Moreover, in his research Asclepiades took heed of a certain reserve akin to the system of controls in our experimental method. He pointed out that the functional products were continually variable, even of the soul; this he explained by the incessant whirling restlessness of the atoms (*κίνησις, φορά, ῥυσίς*); he warned the empirics that therefore two or more observations could never be made under identical conditions. If then Asclepiades, in concentrating his explanation of insanity upon the brain, conjectured that the atoms of the brain were rounder and smoother, and so more mobile, than those in the rest of the body, where they united by hooks, as in our time Ehrlich has supposed, to form a web (*συμπλοκή, complexio*), yet he was led into this transcendental speculation by observation and experiment. In a gibe of Galen's, Asclepiades who, consistently with his theory and with the teaching of Erasistratus, regarded digestion as a merely mechanical grinding and pulping, is derided for not observing different qualities in the digested food, whether in the vomit or "*ἐν ταῖς ἀνατομαῖς*." But I will not attempt to detain you by further illustration of the researches of Asclepiades, for, as in the case of Francis Bacon, his apprehensions were more fruitful than his applications. Thus it was mere logic which dictated to him that the finest atoms must be in the centre of gravity of the body—namely, in the breast; with more truth he adhered to the belief that respiration consisted in the affinity of these finest atoms to the like finest particles of the atmosphere, those nearest like fire or pneuma, or, as we might say, to oxygen (see pp. 114 and 259). The directions of the *φοραί*—the atomic orbits—he explained partly by "logic," yet also (as we might expect from an Alexandrian student) by some physical and mathematical conceptions. For this reason the hypotheses of Asclepiades have been seriously compared with those of the iatro-physicists or iatro-mathematicians of the seventeenth century; but surely this is to forget that in that vast interval the bases of the medical sciences had been wholly transformed. Of philosophy, it is true, the bases continued to be more uniform; Asclepiades, like his intellectual ancestor Democritus, was as convinced a teacher as Locke of the relativity of knowledge and of the relative finality of the appreciations of the senses.

Ultimate substance was ἄδηλον, and we cannot, as he said, carry the bases of our science beyond phenomena (φαινόμενα).[1]

By the way there is a saying of Asclepiades which I ought not to omit; namely that the inhabitants of Great Britain were long-lived. This longevity he attributed to the climate which opposed the dissipation of the "innate heat" which, at its maximum, in infancy, gradually waned through life. Some of us may have conceived a contrary prejudice concerning our own climate.

In conclusion then, by a closer and wider investigation of such fragments and allusions as are extant, and a reconsideration of the ideas, opinions, and traditions of the period, we begin to perceive that to regard Asclepiades as a smooth-tongued and covetous intriguer, bent on plausible inventions and pliable therapeutics wherewith to tickle the fancy of an enervated and self-indulgent society, was an unfair and mistaken judgement. On the contrary, we have seen that this eminent man was educated from his youth for the medical career; that to this end he studied in Erasistratean schools, was perhaps a pupil of Heraclides in Alexandria, and came to Rome inspired by no time-serving, extemporal, or individual sentiments, but by a large and revolutionary system of doctrine, seriously intended to overthrow the post-Hippocratean dogmatism, already combated by the empirics. This system, adapted from the atomic theory of Leucippus and Democritus, and developed in its applications to medical science, had been delivered to him through four or five generations of authoritative teachers; and about the same time this theory and interpretation of life, already for two or three generations propagated in Rome, was to reach its zenith in the splendour of the epic of Lucretius.[2] In common life indeed educated men, and even the general public also, were repudiating the crude tenets and the barbarous practices of the old-fashioned medicine; while, in respect of the empirics on the other hand, intellectual observers, such as Crassus the orator,[3]

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[1] For some references to these materials derived from Sextus Empiricus, Caelius Aurelianus, Galen, Aetius, Cassius the iatrosophist, Antiochus of Ascalon, etc., and commentaries upon them I am indebted to Daremberg, Brieger, and Wellmann.

[2] Certain passages of Lucretius seem to be derived from Asclepiades, *e.g.* vi. 906 *et seq.* On the analogy between molecular movement in respiration and in magnetism, see Fritzsche, *Rh. Mus.* N.F. 1902, lvii. 3363.

[3] Cicero, in writing to Crassus of Asclepiades as both friend and physician (apparently of both ?), says that Asclepiades was indeed eloquent, adding: "In eo ipso quod ornate dicebat medicinae facilitate utebatur non eloquentiae" (*De orat.* i. 14) (date Sept. 91 B.C. J. S. R.).

Cicero, Atticus, Mark Antony, some of whom are recorded as personal friends and patients of Asclepiades,[1] could not have failed to discern the aridity of doctrines which professed to see facts only one by one. Thus the minds of thoughtful Romans were open to consider almost any plausible doctrine of causation, and meanwhile to welcome more temperate therapeutical methods. And it was at this time that Asclepiades arrived from Athens, animated by the atomic theory, a physical conception of nature which in philosophy and literature also had already inspired other eager spirits with the ardour of a revelation, and professing to carry forward a new practice upon those methods of diet, active and passive exercises, baths, and the conduct of life which we honourably distinguish as physiological; a medicine far removed from the spells and elixirs of Cato. That Asclepiades, though the child of a rhetorical age, and of the Alexandrian school where science and rhetoric flourished side by side, was no ineffectual sophist, but on occasion expert enough with his hands, we infer from his reputation as a surgeon, and from the attribution to him by Galen of the operation of laryngotomy.

But what about the ungenerous denunciations of Hippocrates? Why, we shall step out of the study, and apply to these scoffs a little worldly common sense. Asclepiades came to Rome as a rebel, as a disciple of Erasistratus, a "mechanistic philosopher" who neglected the humoral for a solidist pathology, moderated venesection, and used wine cautiously as a restorative. Unfortunately for his renown, his successors degraded his teaching into the dry formulas of methodism which Galen rightly repudiated.[2]

Asclepiades [3] had therefore to fight for his hand against a powerful array of conservative forces and dogmatic precepts, and especially against a jealous and none too scrupulous body of practitioners, all or nearly all of them either dogmatists or pretenders; parties which armed themselves both alike with weapons from the armoury of the older tradition. As for our fathers Moses, being interpreted, meant Bishop Usher, so in the mouths of the Greek doctors in possession "Hippocrates" meant the ossified dogmatics and routine, and the treatment of the patient not as an individual but by humoral and abstract formulas. And it were no inconsistency of temperament in a reformer one day, as irascible man, to throw controversial missiles at the effigy of a Hippocrates or a Moses, and on the next, as sage, to treat their persons with reverence. The remonstrances of Asclepiades were far away from the raw and insolent abuse of Thessalus; such as, that the aphorisms of Hippocrates were all lies. Pliny is the only writer to impute moral delinquency to Asclepiades; the medical botanist, folk-lorist, and gossip and the philosophical physician were irreconcilable. Varro, whose leanings were towards the Empirics, bitterly opposed the Epicureans, and only in this sense opposed Asclepiades. The pharmacist Scribonius Largus naturally protested, though with great respect, against a physician who discouraged the liberal use of drugs. The wise and learned Celsus, in a period when literary acknowledgements were usually disregarded, mentions Asclepiades—so I have computed from Dr. Frieboes's index — no less than twenty-nine times; if often with dissent, yet always with respect, and many times with honour; for instance, as "*auctor summus*," and as one who "*medendi rationem ex magna parte mutavit.*" How paramount in his own day was the reputation of Asclepiades we know from the attempts by other potentates, especially by Mithridates, to allure him elsewhere. Galen, though more acrimonious in dispute than Celsus, yet likewise betrays in his argument, and indeed avows, that the fame and ascendancy of Asclepiades were paramount, and that he was seeking to discredit that repute not in morals but in doctrine. Between such antagonists there could be no intellectual truce; and, as Asclepiades had been in his grave for a century and a half, the illustrious Galen got all his own way in the wrangle. Still I repeat that these angry protests of Galen, for much of which there was controversial justification, were a tribute to the authority of Asclepiades, and carried with them no more imputation of guile or dishonour than in the cases of the blameless Menodotus and others whom he pursued with the same pugnacious eloquence.

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[1] I learn from Professor Reid that the Crassus of whom Cicero (*De or.* i. 62) speaks as an acquaintance of Asclepiades was certainly the orator—the dramatic date being about 88 B.C. He seems not to have been personally known to Cicero. Dr. Reid says Asclepiades must have been somewhat junior to Crassus, but older than Pompey. It would seem that at the time of the dialogue Crassus was no longer in touch with Asclepiades, who must indeed have left Rome some time before that date.

[2] And Galen ruled over medicine till the seventeenth century; though Wellmann makes the interesting point that David Sennert (1572-1637) in his *Physica hypomnemata* awakened the teaching of the great Bithynian from its long slumber.

[3] Galen, Θεραπ. *μέθ.* κ. cap. ϵ′, Kühn, x. 691.

CHAPTER VII

THE DOCTRINE OF METHODISM[1]

LET us now pass on to the doctrine and sect of Methodism—to the argument that the causation of disease lay in constrictions and relaxations of the pores between the atoms of which the body and its fluids, or of parts of them, are composed ; a doctrine which had its birth and life, if not its first conception, in Rome. The Hippocratic medicine, by its strong clinical and natural bias, did much to control the speculative quests of the Ionians ; yet, of their speculations, the atomic constitution of matter was at a later date adopted and largely applied to the interpretation of disease ; by the middle of the third century B.C., as we have seen, Herophileans and Empirics together had shaken the old dogmatic traditions. We have seen also that Erasistratus promoted the atomic theory in Alexandria : but before him probably other physicians or naturalists had applied it to medicine ; among these, earlier in the fourth century, Wellmann (Art. in Pauly-Wissowa) thinks that Aegimius of Elis may be recognised (p. 301). Into Rome, as we saw in the last chapter, this theory was introduced, and there applied and advocated, by Asclepiades ; and thenceforward, in finer and grosser senses, it became the groundwork of the important Methodist school. For this school all pathology was interpreted and summed up in the doctrines of molecules and pores, of *strictum* and *laxum* ; as was homoeopathy in the formula of " *similia similibus.*"

At this day the problems of the permeability of membranes occupy the minds of the physicist on no dissimilar principles; and experiment indicates that the passage of a solute depends upon the size of the pores in relation to the molecular dimensions of the solute. The researches of Maxwell, Kelvin, and J. J. Thomson—to mention but a few recent workers in this field—have linked us so much more intimately with the atomists of old, that we read even the esoteric *Timaeus* with less sense of the bizarre. However, for medicine the doctrines of Asclepiades, and yet more justly those of Themison and formal Methodism, were of course very crude, even as hypotheses; and from the peculiar needs of medicine they soon began to ramble far away. What the art of medicine then needed above all things was not speculation but positive methods and a ruthless fidelity to facts. I have already implied that for medicine even the cramped and illiberal notions of the empirics were at that time less unwholesome than the fascinating and philosophically interesting visions of atomism. Philosophy is one thing, a craft is another; and a craft must walk before it can fly. Atomism did, it is true, recall men to the forgotten solids of the body, yet so very impalpably that not professional antagonists only, but the very nature of things warred against Asclepiades. If the despotism of Galenic tradition became an incubus on medicine, we may surmise that a tyranny of Methodism might have been a worse misfortune. Methodism would have started indeed with a "cito et jucunde," and the western sick might have been spared the flourishes of the actual cautery and the loss of rivers of blood; but the following centuries were rough; perhaps rough handling fascinated them, at least they did not resent it; and if Methodism ignored the *vis medicatrix naturae*, Galenism too often forgot it.

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[1] Aulus Gellius, *Noct. Att.* xii. 5. Sandys's *Hist. Class. Schol* ii. 25. Wellmann, Report of Congress, Koln, September 1908, *Munch. med. Woch.*, October 15, 1908 ; *Neue Brht. klass. Alt.* 1908, Bd. xxi. and art. in Pauly-Wissowa. Un médecin grec du IIme siècle A.D., *Thèse de Paris*, on Fragments of this Physician's Writings in a Latin rendering of Galen's *De subfiguratione empirici. Das med. System d. Methodiker, eine Vorstudie zu Cael. Aurel. De morbis ac. et chron.* pub. Fisher, Jena, 1914, I have been unable to obtain. And I have mislaid my note of the author's name.

To move onwards from Asclepiades; the early atomists had said little of the spatial relations of the atoms, of pores between them. Empedocles supposed that emanations from external bodies passed through pores into and through the organs of sense. Plato supposed his triangles to act in a plenum.[1] Erasistratus and Asclepiades however laid stress on the pores; for instance, if there were no pores in the skin how could we sweat?[2] And

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[1] The πύκνωσις and ἀραίωσις of Anaximenes were to his mind not spatial relations of atoms but extenuation and condensation of a uniform "air." For the extant sources the reader is referred to Ritter and Preller.

[2] I may here recall the contemporary, and especially methodist, idea of respiration by the skin in man.

Themison, a pupil of Asclepiades who is commonly regarded, perhaps conveniently, as the founder of Methodism proper, in the pores almost forgot the atoms themselves. In what kind of association then did the atoms seem to the atomists to be? Had they any conception—to use current terms—of a grouping of the indivisible atoms into molecules? Had Asclepiades for instance in his mind's eye any functional, differential, or heterogeneous segregation of atoms? After some rummage among texts and commentaries, I can give no answer to this question. The difficulty is not so much that in respect of a building of atoms into molecules there is no allusion, as that in the relevant passages of the texts—fragmentary as they are—the extant terms and sentences are at variance, often indeed contradictory. Some Epicureans, using the word *ἄτομος*, regarded these particles as ultimate; others, using the word *ὄγκος*, as a divisible unit; but it is not apparent that any point of physical principle depended upon the difference. The probability is that the notion of systems of atoms, or of compound atoms as molecules, did not present itself formally to these thinkers as a mode of functional development. They supposed that atoms might stick or crowd together, but they looked upon such adhesions as incidental, and usually, as hampering them in their orbits, mischievous. We have seen moreover that the Ionians, whom Asclepiades followed, conceived of the atoms themselves as coarser and finer, and so differential in function. To read more into their expressions—at any rate into their extant phrases—is, I think, to import into them ideas of our own.

What is then the theoretical distinction, if any, which separates Asclepiades from his pupil Themison (*fl.* *c.* 50 B.C.)—the Atomist from the Methodist, the master from the pupil? Why this—that from regarding the atoms as in a plenum, or, again, as raining, rushing, spinning, or whirling in space or spaces, Themison, as I have said, almost forgot the atoms in the pores, or, rather, forgot both in the meagre formulas of relaxation (*ῥύσις, τὸ ῥυῶδες*) and constriction (*στέγνωσις, τὸ στεγνόν*) in this area or in that. Moreover Themison more thoroughly systematised the doctrine, and therapeutical deductions from it. Asclepiades conceived of the atoms as in the first instance in no order (*ὄγκοι ἄναρμοι*) but determined into harmony by passage through the pores of normal tissues; assuming, that is, the atoms to be of proper number and size, the pores of right calibre and direction, and so on. On the other hand they might lose their balance and crowd together, in this direction or in that, so as to cause a stoppage (ἔμφραξις), or at least a retardation (στάσις), of the currents in one part with a corresponding rarefaction in other parts. Of the rarefactions Asclepiades says less than Themison, for whom they loomed larger; Themison contrasted the rarefied parts, where he regarded the tissues as relaxed, with the congested parts where they became choked or constricted. Furthermore, the atomic dispositions were not always beneficent in the Hippocratean sense of the *vis medicatrix naturae*; nor teleological in the Aristotelian sense; they might be well disposed or ill disposed. Thus pain, for Asclepiades, consisted more particularly in a sense of stoppage, of aggregation of coarser atoms—as in thick blood for instance; Themison reduced it to a mere *strictum*. In their respective explanations of fever likewise there were the same differences; quotidian fever consisted in choking, or constriction of the larger pores of the body, quartan in choking of the finer. Generally speaking, for the Methodist, acute disease was a *status strictus*, chronic disease a *status laxus*;[1] a solidist pathology standing of course in contrast with the far better known humoral pathology which on the whole, in spite of Haller, was in the ascendant even down to the time of Virchow. For pain then Asclepiades conceded that venesection, preferably local, might fairly be practised, though cautiously and only for instant relief; for he argued that on the whole "bleeding tended to draw off the finer, the more vital, atoms first, leaving the coarser behind"; so that rigor, due to a peripheral viscosity, might follow venesection. Again, when arrests took place in certain parts, as in glands or in a lesion of a limb, the swift atoms, finding themselves thwarted in their orbits, would sweep upwards from the obstruction; and if from an extensive closure of the pores of the system would thus set up general fever. Of relaxants were, *e.g.*, bleeding and massage; of tonics wine, cold water, vinegar, and narcotics.

I may digress not inconveniently here to remind the reader that the interpretation of fever was one of the great questions of the schools. The solution of the atomists we have noted. Diocles held, and Galen took a similar view of it, that fever was a contingent effect (ἐπιγέννημα) of some morbid process. Galen's not irrational view that all fever depended upon some focus of inflammation, especially if pus were forming, was over-emphasised in later times by Broussais. Other schools attributed fever to plethora; the Hippocrateans to bile or, with Empedocles, to excess of innate heat[1]—the degrees of malaria for instance were degrees or kinds of biliary crasis. External poisons however, such as bad food or bad gases, were not forgotten; for to some such agency Thucydides tells us the great plague of Athens was attributed. By the Methodists however these doubts and conjectures were all diluted into the thin conceit of a mere *strictum*, more jejune even than the Asclepiadean cloggings (σῶμα δυσδιαφόρητον) of the pores. This rule was one of the universals (κοινότητες) of the Methodists; the other two chief *communitates* being the "laxum," and a third or mixed state (μεμιγμένον); this last category being one of those shifts for the disposal of awkward instances to which most system-mongers are driven, only to find it uniting the difficulties of both extremes. This category of "mixtum" which of course swallowed up most of the cases, was inserted by Themison.

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[1] That Asclepiades, or any other one physician, propounded the distinction between Acute and Chronic Disease I can hardly admit. The prevailing notion in the time of Hippocrates seems to have been that Chronic Disease was a sequel of Acute, and this notion became modified gradually.

On these universals Soranus wrote a book, lost with the rest of his works. Thus conceptions which in Asclepiades were an endeavour, on the basis of the Democritean physics, to range biology with the positive sciences, to bring medicine into contact with physical methods, and to anticipate Haller by taking the solids of the body into the reckoning, were, by the extravagances and fantasies of his immediate successors, the Methodists, attenuated into the flimsiest of cobwebs. As Wellmann says, Asclepiades was too hard for his successors. It was to the most meagre of these notions that the Methodists referred all phenomena; they scorned axiomata media, and sought to know the whole without knowledge of the parts. For them the problem of diagnosis was not—What are the phenomena? but How far could the malady be thrust or evaporated into a *communitas*—a *strictum*, or a *laxum*, or a *mixtum*? Therapeutics accordingly depended simply on parallel columns of diseases and laxative, tonic, tono-laxative agents—a facile device that did something to discourage polypharmacy. But, as Galen happily retorted, Humanity, for example, is a universal, but, in the examination of individual cases or even in an inquiry into the species and sorts of Man, one very vaguely useful, so in disease the physician must pay regard not only to particular symptoms and characters, but must inquire also into what Galen called the procatarctic (occasional) causes ; such as climate, age, sex, habit, and the like. To Asclepiades this aspect of causation was familiar ; he taught, for instance, that diseases behaved differently, and patients tolerated treatment differently, in Rome and in the Levant. However, too often these discussions were, after all, fights between one windmill and another. It is curious that each in his own extreme, the Empiric and the Methodist alike, the Empiric glued to the particular, and the Methodist blown into the universal, dispensed with the need of inquiry into causes, or indeed into processes. While for the Methodist the specific fact was as soon as possible to be sublimed into one of his three universals, for the Empiric it was an ultimate ; the one refused to see it, the other refused to link it up. This was a sad falling-off from Erasistratus, who made many necropsies (p. 153) ; who had discovered, for example, that in ascites the liver might be of stony hardness. Anatomy was obviously unnecessary.

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[1] See testimony Alex. Aph. *De febribus*, Ideler ii. 82 θερμασία παρὰ φυσὶν ἀπὸ καρδίας. So for Chrysippus and Erasistratus the blood was drawn into the arteries and the pulse-rate accelerated. (See Cael. Aur. and Galen xvii. K.)

But the Methodists themselves began to find out—or it was found out for them—that to reduce medicine to two or three abstract categories was, because of its very facility, to reduce it to a vapid and fruitless pretence ; they had therefore to formulate other universals subordinate to the chief triad. Yet even then, for the explanation of poisoning, of the invasion of foreign bodies, of tumours, and of surgery in general, the idea was unworkable ; or at any rate, in its emptiness of content, futile.

The parallel categories of practice to which their therapeutics were conformed were necessarily of *contraria contrariis* ; if, as in the first stage of fever, there was constriction, then relaxants were to be used ; if, as in the second stage, there was relaxation, then astringents. So again in presumptive local leaks or stoppages, astringent or solvent remedies respectively were to be directed to the affected areas. It is easy to see how such rules-of-thumb must lead, as in fact they did, to the vainest and most senseless routine; and how destructive they were of the method of Hippocrates which, as Celsus wrote, was that cure depends upon attention to symptoms both general and particular (*mederi oportere et communia et propria intuentem*). Still, as in all revolts, the leaders, to judge by the relics of them down the centuries in Oribasius, Aetius, Alexander of Tralles, were better than their followers. But I must permit myself again to commend one excellent and permanently influential side of their therapeutics, derived from their forefathers Asclepiades, Erasistratus, and Diocles, that which, congruently with their physical views, led to the correspondent extension and development of the physical means of cure—of surgery (Soranus), of passive movements, graduated exercises, special baths, diet, regimen, and so forth, with vigilant waiting upon nature. Their insistence on dietetics did great service for later generations. These were the methods which in the hands of Asclepiades supplemented the antique and barbarous practices of Archagathus and restored the rational moderation of Akron, Philistion, and Diocles. A proverbial rule of the Methodists, which again we trace back to Asclepiades and Erasistratus, was the well-known three days' abstinence with which in acute disease they commenced the treatment. It was in the later stages that they recommended wine and good feeding.

Ancient dietetics were of course influenced or even ruled, more or less, by the philosophy of the corresponding period; and the hygienic philosophy of the Hippocratean period was, as the rest of Ionian ideas, an example to all later times, even to our own. The central idea of Ionian hygiene was that of the place and integration of man in the cosmic process, as a developing organism keyed into, and interpenetrated by, external nature; man's φύσις and external nature being one system. Thus without an appreciation of the facts and course of nature, and of natural law and order, man and man's nature could not be interpreted. So grew up the theory of the "milieu," out of which arose natural methods of healing, and the system of physical hygiene and consequent therapeutics on which the first formal discourse was the celebrated Hippocratic treatise on *Airs, Waters, and Places*. The therapeutics at Epidaurus were natural and rational, consisting of baths, gymnastics, massage, and open-air methods. The use of certain drugs and epithems—of hemlock for instance as a sedative, was quite subordinate.

From the Hippocratic schools these doctrines were carried forward by Diocles, through Philistion to Plato; thence to the Alexandrians, and so by Asclepiades to Rome. This way of regarding man in respect both of mind and body, as in his functions acting and reacting with those of his external conditions, in later Rome, and in the Middle Ages was, as we have seen, blurred, choked, and perverted by fantastic drugging and sorcery. (See chap. Pharmacy, p. 347.)

In obstetrics the Methodists attained distinction especially in the person of *Soranus*, whose fame, and the fragments and titles of whose works, testify, as we shall see, to remarkable abilities, not in obstetrics only, but over the whole sphere of medicine. The man is reflected in his terse, lucid, shrewd and practical style. From the relics Soranus has been, as it were, reconstructed by Reinhold Dietz of Königsberg, another of the company of learned physicians carried off prematurely by death. The development of obstetrics probably arose out of the Alexandrian anatomy; we know that Herophilus wrote upon the subject. *Thessalus*, the son of a woollen weaver of Tralles, who turned from this trade to medicine in the reign of Nero, reveals himself to us on the contrary as an arrogant boaster; and not only as vainglorious, but as the captain of troops of pretenders, to whom he promised for a fee to teach in six months all that need be known in medicine. He is said to have rushed about from house to house followed by a rabble of disciples. Such medicine as Thessalus had to teach might have been written on the proverbial half-sheet of notepaper, and learnt for less money in as many hours. He dedicated his books to Nero, whose attention he had attracted. In an appeal to Nero, he vaunted himself as the foe of doctors, and on his ostentatious tomb in the Appian Way inscribed himself as Iatronikes. Certainly he vanquished whatsoever there were in the science and art of medicine, of understanding, of skill, of patience, and of honour; and must have revealed to the more respectable Methodists how near are the boundaries of vanity of doctrine and vanity of conduct. Asclepiades was the forerunner of the Methodists it is true; but it was by Themison and his school that the atomistic conceptions, which at best lent themselves too readily to fantasy, were so reduced, both in theory and practice, to summary forms as to be comprehensible by any illiterate charlatan. It is fair to add that, in the generosity of modern historians, an attempt has been made to "whitewash" Thessalus,[1] but with little effect. In his animadversions on Asclepiades Pliny among the ancients stands alone, and by Celsus and others is contradicted; in his appreciation of Thessalus as a vulgar pretender Pliny is supported by Galen [2] and Caelius Aurelianus, and contradicted by none. Moreover Meyer-Steineg's own thesis, if it stood alone, is far from convincing. Galen did not denounce Thessalus merely as one of the Methodists. He says "the disciples of Thessalus were, it is true, Methodist by title; but in respect of facts without any method, and in character, boastful and ignorant." Yet Thessalus claimed to have completed the theory of Methodism (ἐτελείωσε αὐτήν) by eviscerating and pickling it in the formulas (κοινότητες) *strictum* and *laxum*, and virtually denying the Hippocratean *vis medicatrix naturae*. And that Thessalus was the first to distinguish between Acute and Chronic diseases surely cannot be maintained for a moment. So far as Acute and Chronic diseases are to be separated, common sense must have done it from early times; for instance:

> τίς νύ σε Κὴρ ἐδάμασσε τανηλεγέος θανάτοιο;
> ἦ δολιχὴ νοῦσος; ἦ Ἄρτεμις ἰοχέαιρα
> οἷς ἀγανοῖς βελέεσσιν ἐποιχομένη κατέπεφνεν;
> *Od.* xi. 171 ff.

Themison at any rate was before him in accentuating the division of diseases into the Acute and Chronic (*teste* C. Aureliano), the primarily chronic affections being distinguished from the sequels of the acute; although he still regarded the time relations as being often an inessential character. Thessalus, in crudely insisting on a radical distinction between these two classes, rather hindered than promoted the interpretation of disease. Thessalus was no doubt a clever fellow, and well understood the arts of self-advertisement, but he marked, not the flood but the ebb of Methodism; and although under Trajan and Hadrian Methodism rose again for a while into its highest consideration under physicians such as Soranus, yet this was rather in name than in content: the sect had transcended itself by bursting its bonds and spreading into an indeterminate eclecticism. It may be said for Thessalus that by brushing aside the dogmatic precepts and formality of the later Hippocrateans, and insisting on bedside experience, he may have done some good. For instance, as a practitioner, he divided diseases into those remediable by diet, and those dependent upon the intervention of drugs or surgery. Likewise on clinical indications he divided, or emphasised the division, of symptoms into the General and Special, and seems to have recognised somatic as well as local tonus. This, on the evidence before us, is the utmost allowance we can make for him.

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[1] See Th. Meyer-Steineg, "Thessalos von Tralles," *Arch. f. Gesch. d. Med.*, 1911, Bd. iv.

[2] Galen xviii. a, p. 269 ff. and x. 5 ff. Also, as against the Methodist Julianus, xvii. a; see also the *Therapeutices Methodos*, x. 5.

In pursuing the story of the Methodists and mentioning therein Themison, and his successor Thessalus, for the moment I passed by the far greater or at any rate more important, name of Celsus who lived in the reign of Tiberius; this I have done in order to give him a chapter to himself.

In later chapters we shall see that in details, if not in principles, Methodism persisted for many following centuries and formed a part in the earlier Salernitan teaching (p. 437). Daremberg discovered a *Summa Medicinae,* strongly coloured by Methodism, which had a great vogue in the Middle Ages. It is a compilation from various sources, and was "re-edited" by Gariopontus about A.D. 1040 (p. 434). A little later Galenism gained the ascendancy (p. 438).

CHAPTER VIII

CELSUS : MUSA : PLINY

THE treatise of *Celsus* on Medicine, the first systematic treatise which has come down to us, was, as I have said, lost until the fifteenth century, when it was rediscovered, so we are told, by that respectable Pope Nicholas V. The facts, according to Sabbadini, are that the first and less correct MS. was found at Siena by the humanist known as Il Panormita ; but that soon afterwards a better one came to light in the Ambrosian Library. I suggest that this MS. may have come from Bobbio, for many Bobbio MSS. found a home there ; and Gerbert, in the tenth century, is one of the very few writers who quotes Celsus (Letter 169). He was quoted by Isidore also ; later, as a *military* writer, by John of Salisbury ; and once again by Simon Jannensis (about 1288) in his *Clavis sanationis.*[1] These seem to be the only mentions of Celsus in the Middle Ages ; on the other hand Guy of Chauliac, who mentions many a name, never alludes to Celsus. There may be one or two glimpses of him in Cassiodorus. It was his beautiful style that brought him credit, his latin rising as, in the West, greek letters waned. So it would seem that portions of Celsus, under whatsoever titles, had survived in cloister libraries. We have observed that under the Empire greek was the language of Medicine, as is german in Japan to-day. A physician of that day, writing for physicians, could hardly have written in latin.[2]

The *De medicina* was printed in 1478, at Florence ; and from that time Celsus sprang into fame, if chiefly in humanist circles. Politian took some pains with the text of Celsus, and it is interesting to remember that of those who attended Politian's lectures were Grocyn and Linacre. If written by a Roman patrician and layman, the latin treatise of Celsus would be safe with his own coterie; it would not have aroused, and be kept alive by, professional jealousies. The spiteful arrows—*e.g.* of Pliny—were shot elsewhere. Thus neglect, unmerited neglect, might, and did, overtake Celsus; but not, as in the case of Asclepiades, contumely. Celsus then, invaluable as a historian, as a person was hardly a link in the chain of medical tradition, or a part of its continuous story.

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[1] Celsus was quoted by Pliny, and was apparently known to Sextus Empiricus c. A.D. 400. In the Middle Ages besides the mention in Gerbert's *Letters* (Ep. 15) (tenth century) and in the *Clavis sanationis* of Simon of Janua, physician to Pope Nicholas the Fourth already indicated, Marx has found a quotation from him in Muscio (see p. 217).

[2] The few medical books in latin were mostly translations of the fourth to fifth century ; *e.g.* Theodore Priscian, C. Aurelianus, Vindicianus, etc.

In later times however this treatise by the "Cicero medicorum" has attracted more and more attention in the history of Medicine, especially of the School of Alexandria; and from Renaissance times, for the beauty of its form and the sagacity of its argument, has commanded admiration as literature. It has been edited again and again; as by De Renzi, by Daremberg, by Vedrènes, by Frieboes, by A. and I. del Lungo, by Marx; but the only notable textual revision, since that by Targas in 1769, was by Daremberg. The progress of research has however been such as to leave these editions and their commentaries, useful as they have been, somewhat belated. Fortunately the edition, by Marx, of the text for the Corp. Med. Gr. (Teubner), appeared in 1917, with 100 pp. of Prolegomena dealing with the life of Celsus, and the "Kultur" of the second century. The text is based upon that of Daremberg, and has been thoroughly and perhaps finally established by comparison with all known MSS.; for Marx found even Daremberg's text not immaculate.[1] A masterly survey of Celsian medicine, and of its Greek and Roman sources, to which I am indebted, has been written by Ilberg;[2] yet parts even of this recent study—as we shall see presently—have since been called in question.

Celsus may have been born at Narbonne (Marx), about 25 B.C.; that he was a layman I have already presumed; this seems almost certain from the following considerations: that he was not recognised or even mentioned as an authority by physicians, neither in his own day (under Tiberius), nor in later Roman times :[1] that, like his predecessor Varro, and many other didactic writers, he was among the first and chief of the long order of compilers, medicine being but a section of his whole work. Cato was but a rudimentary forerunner. It is known that Celsus wrote also on Agriculture, on the Military art, on Rhetoric, on Philosophy, and on Jurisprudence : "non solum de his omnibus conscripserit artibus sed amplius rei militaris et rusticae et medicinae"[2] etc. Unluckily no scrap of these remains for a comparison of style and content. We have seen that some knowledge of medicine was then customary among educated men in Rome, and domestic medicine practised by the head of the household on family, slaves, and cattle.[3] Oribasius quotes Athenaeus as of opinion that no man of rank and responsibility could afford to be ignorant of medicine. Celsus may have thus practised medicine in his own household, as he may have practised agriculture and other homely arts. Again, in his index, Pliny puts Celsus not among *medici* but among *auctores* ; and Quintilian speaks of him as "vir mediocri[4] ingenio" who wrote on many subjects. To these considerations I would add that to a professional reader the handling of the subject, masterly as it is, here and there is not quite intimate, or is indeed superficial or formal ; that certain unseemly details of our craft are less frankly expressed than is usual in medical books ; that in places folk-medicine is mingled with academic, and that, as I have said, he wrote not in greek, which was then the language of the medical faculty, but in excellent latin not even, as in Cicero, garnished with greek. However Professor Reid has impressed upon me that whether Celsus were a physician or not, he should not be regarded as an ordinary compiler. Such remnants as we have of Varro seem to have more of the characteristic defects of the compiler. Both of course were far more solid than Pliny; but in Celsus Dr. Reid finds a "sureness of touch" and I may add a completeness and symmetry which lift him above his fellows; a criticism with which I cordially agree. A not impossible alternative is that Celsus translated or incorporated a Greek treatise, now lost; and invested it with his own qualities of sound judgement and beautiful latin. But to the vexed question of actual authorship I shall return. No humanist, since the revival of learning, has failed to appreciate his strong, lucid, and elegant style; somewhat to the neglect of his matter. Indeed Celsus, or whosoever wrote the *De medicina*, may be said to have created scientific latin. As Ilberg puts it, by weighting latin prose with the matter of science, and by careful rhythm of phrasing and cadence, Celsus carried from greek to latin a new quality of style, and for science did what Cicero did for philosophy. We shall not forget the familiar quotation from Fabricius ab Aquapendente, "Admirabilis Celsus in omnibus, quem nocturna versare manu, versare diurno consulo."[1] "I would bear something," said Samuel Johnson, "rather than Celsus should be detected in an error."[2]

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[1] See Wellmann, *Berl. phil. Woch.*, 1914.

[2] Ilberg, *N. JB. klass. Alterthum*, vol. xix., 1907. A good account of the gynaecology of Celsus, by Lachs, Martin and Sangers, is to be found in the *Monatsschr. f. Geburtshf. u. Gyn.* Bd. xv., 1902; of this paper I have seen only extracts. J. Hirschberg, *Berl. klin. Woch.*, 1918, Bd. lv. 3 nos, contains nothing new.

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[1] Galen's "Cornelius the physician" was another person.

[2] Quintilian, *Inst. orat.* xii. 11. 24 (quoted Haeser).

[3] Test. Pliny, Plutarch, Seneca, Aulus Gellius, Orib. (iii. 168), etc. etc. Veterinary medicine was an old tradition even in Greece, and thence came early to Rome. Cf. Xenophon, Περὶ ἱππικῆς, etc. But it was probably a very meagre craft. One Mago, a Carthaginian, about 200 B.C., wrote twenty-eight books on the subject, which served as copy for later writers. The first systematic treatise was that (*Mulo-medicina sive Ars veterinaria*) of Vegetius, a shameless plagiarist, yet nevertheless the source of subsequent writers.

[4] Here *mediocris*, usually taken to mean inferior or slight, probably means fair—a man of fair abilities.

As, in his masterly *Prooemium* and throughout his work, Celsus is in some respects a principal historical authority, it is very important for us to know whence he derived his information; what were his sources.[3] Ilberg thinks that Celsus took his Hippocratic materials, which formed the backbone of his treatise,[4] from the Canon directly; also that the works of Erasistratus, of Asclepiades and his school, of Heraclides, of Tarentum, and of Meges were actually before him. From this opinion Wellmann dissents; indeed, after a long argument, he goes so far as to fix upon one Cassius (not Felix), whom Celsus lauds, as his main if not exclusive source. The evidence for this assumption seems to me to be very tenuous. Ilberg's, Wellmann's, and Marx's researches discover in Celsus, as we might expect, a "mosaic" of materials and doctrines, most of which, even if taken immediately from a Cassius or a Titus Aufidius Siculus,[1] may be traced backwards to their original sources ; for instance, in the therapeutics of insanity Wellmann finds matter from Asclepiades, Themison, and Heraclides, but not in such identity as to lead him to suppose that Celsus had the writings of Heraclides in his own hands.

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[1] Professor Scheller of Brunswick says, of the distinguished and beautiful ("edel und schön") language of Celsus, that it is not that of the golden age of latin literature; and on this argument would carry his date down to the reign of Claudius.

[2] *Piozzi Letters*, i. 89.

[3] In what follows I am indebted also to an article by Wellmann in the *Philolog. Untersuchungen* of Kiessling and W.-Möllendorff, Berlin, 1913; and again to Marx's *Prolegomena* (*loc. cit.*).

[4] See Daremberg's collection of parallel passages. His greek technical terms were often Hippocratic, though not a few Alexandrian.

Upon what source or sources Celsus directly relied must be of course a matter of particular proof. But we need feel little doubt that in all probability there was in his time no lack of medical literature ; books were accessible in abundance. Copies of the Hippocratic Corpus to which, as I have said, in spirit and letter Celsus was deeply indebted, were probably to be found in all principal centres of study ; we know that they existed in Pergamon, in Alexandria, and presumably in Rome. And most learned Romans in Celsus' day travelled abroad. Of Galen's great library and of that of Serenus Sermonicus (" 62,000 vols."), we know something ; these were of course of a later date, yet, to confine ourselves to the time of Cicero, it is asserted, if probably with some exaggeration, that Tyrannion his librarian had 30,000 " volumes " under his care (Suidas). He also arranged the great library of Apellicon which Sulla brought to Rome, and which included certain MSS. of Aristotle, alleged to be autograph. After a great part of the Alexandrian Museum Library had been burned in the siege of Caesar, Antony is said to have given 200,000 volumes to Cleopatra for Pergamon.[2] The great library of Pax is mentioned by Celsus himself. Pliny, and Plutarch again (for his *Lives* and *M. Moralia*) must have had access to large libraries. We learn moreover that Varro, an earlier encyclopaedist, consulted greek books by the score. We may presume then that in the time of Celsus the works of the chief medical authors were not difficult of access.

For my own part, for reasons into which it were tedious to enter fully now, I am indisposed to assume with Wellmann that Celsus took matter in block from the Cassius, whom he names,[3] without directly consulting the works of physicians, such as Asclepiades, Heraclides, or, for surgery, Meges, who lived no very long time before him, and whose works cannot have been out of reach. The variations and similarities adduced by Wellmann, notable as a few of them are, are scarcely conclusive enough to convince me that a writer of the ability, vigorous judgement, and remarkable historical sense of Celsus neglected to consult the standard works on the subject which he undertook to expound, or contented himself with second-hand and incongruous furniture. Moreover his celebrated *Prooemium* must have come from his own hand. Wellmann's strongest points are of course those of coincidence and difference; but none of these is incompatible with the supposition that, as a layman but a layman educated in medicine, he may have made use of Cassius, or another, as a handbook, while nevertheless looking back frequently, if not systematically, to standard sources; though in part no doubt quoting also from memory, as in those days was usual. As himself the author of a handbook, his method would be breadth rather than detail; and such in fact was his achievement. Again, I should expect that in all periods and all studies, but especially in times of much tradition by memory, each school had its large stock of "common knowledge" and common language, much of it learned more or less exactly by heart. Furthermore, as Kind has pointed out,[1] Cassius was a Methodist, a sect which Celsus regarded as narrow and retrograde. However, whether mediate or immediate, it would be none the less interesting to ascertain the more original sources of his information. In the main of course it was derived largely from Alexandria—from Erasistratus chiefly; in smaller measure from Herophilus—and thence backwards from Ionic—Cnidian and Coan—tradition and writings. Its scholastic colour is Eclectic and "Dogmatic," but largely Empirical. His anatomy is good, and he urges the importance of anatomy as the basis of medicine. From his own books, and from Wellmann's researches, it appears, as I have said, that Celsus was indebted more directly to Asclepiades—an author often mentioned by him with high esteem—to Heraclides, to Themison, his later limit, and to the

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[1] Fragments of this author (*c.* 50 B.C., a pupil of Asclepiades) embedded in Caelius Aurelianus are almost identical with certain passages in Celsus (Marx).

[2] There is no nearly contemporary evidence that the "Alexandrian Library" was burned by the Arabs. Indeed neither of these great libraries then existed. The Seraphan had perished, or been removed, before 391 A.D.

[3] There were three physicians of the name : viz. this Cassius mentioned by Celsus ; C. the iatrosophist ; and C. Felix of unknown date whom Daremberg put in the first century A.D., and attributed to him a MS. now in Cambridge University Library ; others carry

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him down to the fifth century A.D., the thoroughly "second-hand age" of such random pillagers as Martianus Capella.

[1] Kind, *Berliner phil. Wochenschr.*, 1914.

great Methodist surgeon Meges of Sidon, from whom it seems certain that he drew much of his excellent surgery, the best part of his treatise. This section he presented even more fully and correctly than we find in Oribasius; as for example in the section on Fistula (Wellmann). Herein indeed we find one of the notes of a translator or compiler, that although Celsus describes many new and valuable surgical methods, he never claims one of them, nor even suggests that he had himself performed any of them. We possess so little of the writings of any of these primary authors that though by careful comparisons the chain of ideas may be linked up, a clear opinion as to direct sources seems impossible. Unfortunately, as we have continually to regret, the ancient medical writer rarely named the author whose materials he was using, unless on occasion to assail him.[1]

Marx, in the *Prolegomena* to which I have referred, proposes a still more sweeping hypothesis. Historians have never felt quite able to reconcile the judgement of Quintilian on Celsus, as a man of no remarkable endowments, and the silence of subsequent authors concerning him and his work, with the learning, wisdom, balance, and style of the treatise which passes under his name, a silence which becomes intelligible if Celsus were but a translator. Marx therefore would make almost a clean sweep of Celsus as an author, and regard him rather as a general editor of a cyclopaedia; while he attributes the Section on Medicine not to any Cassius but to the Titus Aufidius Siculus, already mentioned, the disciple of Asclepiades and author of a lost work on Chronic Diseases. German "Quellenkritik" is an ardent pursuit which often overleaps itself, and its discoveries must be received with caution and discretion. Professor Reid thinks that the present fashion of bringing out-of-the-way names to re-label ancient works is a modern emulation now being carried too far; and that the notion of a general editor of an Encyclopaedia by several hands is wholly modern, unsupported by what we know of other ancient encyclopedists, and not to be thought of for the Early Empire. I may add that if Celsus, of whose merits we have no other external evidence, were forgotten, so also was the admirable treatise itself, concerning whose merits we have no doubt; that whosoever wrote the *De medicina* was deeply impressed by the teaching and personal ascendancy of Asclepiades; and that (see *e.g. D.M.* iv. 9. 3), so far as the " style " of Celsus is incomparable so far is the work a work of one individual author.

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[1] We gather from Caelius Aurelianus that Soranus did acknowledge his sources; unhappily for the most part his works, save as in Caelius, have perished (p. 215).

As to his philosophy Celsus was a " Trimmer," in the Halifax sense; a " via media man." He wrote, broadly speaking, from an empirico-sceptic point of view, the view of the younger empirical school (see p. 169). On the whole however he kept the *via media* between the dogmatic and empirical schools, and in his Preface laid chief stress on art and experience. He was indisposed towards anatomical research, urged individualising (*διορισμός*), and looked to immediate rather than to remoter and profounder (*ἄδηλα*) causes; yet he found a place for " Logos," " ratione vero opus est ipsi medicinae " (viii. 33). If, as we might expect from Herophilean and Roman practice, Celsus relied, more than did the older Greek schools, on drugs, yet in his following of Asclepiades he relied no less on physical therapeutics, and on general hygiene. It is interesting to note that for air and exercise this Roman gentleman recommended not so much gymnastic drill as sports—hunting, fishing, sailing. He dwelt also on age, climate, seasons, but above all on the constitution of the individual. In teaching that diagnosis and prognosis must precede treatment, he confirmed the sound doctrine of the Hippocratic school; and all this he set forth with lucidity. My own impression is, on considering the therapeutics of Celsus, especially the discarding of purging and venesection—thick and dark not ruddy bright blood might be drawn (liv. 33)—the inclination away from pharmacy to physical methods, such as baths of many kinds, massage, gymnastic, games, hygienic and dietetic rules, that his methods are significant of the prevailing influence of Asclepiades. He credits oil massage directly to him,[1] approves the treatment of insomnia by such means instead of by drugs, and the treatment of mania by psychical methods such as certain *modes* of music, a Pythagorean tradition [2] (pp. 186 and 256). In more than one place Celsus seems indeed to refer to the text of Asclepiades; *e.g.* against bandaging the limbs in " faucial " haemorrhage.

In respect of the " empirico-sceptic " point of view I have said that Heraclides was of the same school of thought (p. 370). His bent also was empirical; he too distrusted reasoning on latent causes (*ἄδηλα*); but, like many other empirics, drew his facts from a study of the experience of the older writers as well as of his own. Heraclides (*fl.* 160–110 B.C.), of a generation before Asclepiades, was a physician of great renown, and so widely known that he was commonly spoken of simply as "the Tarentine."[1] He taught medicine in Alexandria, and published a work under the title of *Symposium*; Wellmann notes that among the many remedies which Celsus gathered from Heraclides not a few were of Egyptian origin. To Heraclides, directly or indirectly, both Varro and Celsus were no doubt much indebted. From him Celsus derived many passages on dietetics, pharmacy, therapeutics, and on Hippocratic exegesis. In Pliny (*N.H.* xx. 26), Soranus (Caelius A.), and other sources, there is evidence that on these subjects Heraclides had made excerpts from the Hippocratic treatises; *e.g.* from the *Female Diseases*, from the *Regimen in Acute Diseases*, from the *Humours* and from the *Inward Diseases*; so that these, it is true, Celsus might have collected from Heraclides; but this is not all: Celsus made quotations also from the *Prognostikon*, the *Aphorisms*, the *Coan Prognoses*, the *Prorhetikon*, the *Articulations*, the *Fractures*, the *Wounds* of the *Head*, the *Heart*, and the *Affections* (*Περὶ παθῶν*). However, as some words in Celsus are of post-Hippocratean date, he may possibly have made even these extracts not directly from the sources but from Heraclides. We have continually to remember that literary credit and exactitude were in those days undiscovered virtues.

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[1] See however Hipp. Κατ' *ἰατρεῖον* (Littré, iii. 323).

[2] See C. Aurel. *M. Chr.* i. 5.

It is remarkable that under the head of Fevers Celsus appears most definitely on the Empirical side. Here all speculation is dismissed; to causes he gives no heed whatever; he regards exclusively the clinical picture, and the empirical remedy. In the treatment of fevers he followed the ascetic rule of Asclepiades for the first days—that is starvation and thirst; but he leaned to the more merciful side, watching lest the patient be weakened.

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[1] There were two other physicians of the same name; one mentioned by Galen (and Diogenes L.) as a good commentator on Hippocrates. The curious inference is drawn from more than one instance that even Galen had not the works of "the Tarentine" under his own eye, but quoted him at second hand from Rufus, Soranus, and others. But, when we remember how great a library Galen had collected, may we not rather attribute variations and inaccuracies of text, and even current paraphrases, to slips of memory or carelessness of texts or of sources? (See *Hermes*, vol. xlvii. 4 ff. and xxxv., 1900.)

He noted the divergent opinions of physicians as to the times and ways of enlarging the diet in fevers. Asclepiades appears to have been the first physician in history to call in question the doctrine of Critical Days. The Empirics held to the critical days, but Celsus (lxxx. 24), in following Asclepiades on this principle, manifested a like sceptical spirit.

So far as extant sources go Celsus was the first physician to propound the classical characters of inflammation; *notae inflammationis sunt quatuor*; namely "rubor et tumor cum calore et dolore." In the three forms of Angina and their treatment Celsus followed Asclepiades: but not in his tracheotomy, which indeed made no way with any of his successors. Soranus and Archigenes declined it.[1]

Notwithstanding, Celsus, in animadverting upon the narrow dogmas of the Methodists, even remonstrated with them on their neglect of causes; showing himself, as I have said, to be the more liberal kind of Empiric who accepted some responsibility for "ratiocination" (*λογισμός*), for some integration of thought with observation (*πεῖρα*). This function of induction in practical medicine had been taught by Menodotus of Nicomedia (p. 170), who taught also the value of analogy (*μετάβασις τοῦ ὁμοίου*), or arguing from like to like—*e.g.* from an old to a new disease—and of testing reasoning by practice (see Celsus ix. 9). But indeed before that time, as we have seen (p. 170), the doctrine of analogy had been taught, for good and evil, in Alexandria—as Serapion *c.* 200 B.C.—as a maxim of the Empirical School. As regards the medical philosophy of Celsus it must suffice then to state that he marched in the steps of the great school of Hippocrates not slavishly but as developed by the Alexandrian physicians. This tradition received the name of the Dogmatic school, a name which, in what it connotes for us, is an unfortunate one; for the virtue of the school in its best representatives consisted in great part in its observance of the natural play between *λόγος* (thought) and *πεῖρα* (experience); in its breadth of outlook on knowledge as a whole; in a distrust of speculation, teleological, and other, tempered however by no less an aversion from the shallower kind of empiricism. To quote his own words "Itaque ista quoque naturae rerum contemplatio quamvis non faciat medicum, aptiorem tamen medicinae reddit" (*S.* viii. 29). In our modern terms we might well for "Dogmatic" read Orthodox—the upright inquirer; or if this word also has gathered some dust—we might call him a *via media* man. He desires "quae maxime utraque parte dicantur, quo facilius nostra quoque opinio interponi possit." And again "Ea neque addicta opinioni sunt neque ab utraque nimium abhorrentia, media quodammodo inter diversas sententias, etc.,"—the standpoint of probability. Unhappily the dogmatic school fell, or was falling, into a hard shell of the letter, and an atrophy of the spirit.

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[1] See Caelius Aur. and Aretaeus i. 7. 277.

Upon *Antonius Musa* I shall not tarry long. Like certain modern physicians, he shines by the reflected light of his illustrious patients rather than by his own. On the course of thought, or of medical art and science, he had no permanent influence. Yet, as Dr. Crawford says,[1] a medical clientèle which included Augustus, Virgil, Horace, Maecenas, Marcus Agrippa, is unique in story; probably unrivalled.

The careers of such Greek physicians as Asclepiades and Musa, neither of them tame therapeutists, bear witness to the citizenship and social consideration of the more able and better-educated physicians in the Republic and Early Empire; although, in the absence of any register of the duly qualified, practitioners of the lower ranks brought Greek medicine into some contempt. Musa however was a man of insight and honourable independence of character. He is not known to have helped to poison anybody. He urged the importance of the study of normal conditions, and of the earliest deviations from health. For the maintenance of health he advised periodic abstinences, regular baths, and the use of a certain omnipotent mithridatic. This medicine must have had stupendous virtues, for betony he found to be good for forty-seven diseases! Nevertheless Musa followed Asclepiades in a somewhat audacious use of "physical" means; it was indeed by some luck in the administration of a cold bath that he gained the favour of Augustus.

Not a few recipes under the name of Musa are scattered through the literature; and two books or epistles entitled respectively *Libellus de tuenda valetudine, ad Maecenatem*, and *De herba betonica*, are attributed by pre-Arabian tradition to Musa.

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[1] See R. Crawford, Essay on Ant. Musa in Osler's *Festschrift*. I have to thank Dr. Crawford for his great kindness in allowing me to see his MS. before publication.

The only argument for genuineness besides mere tradition is that writers of such *pastiches*—for they are little more—usually fasten them upon names more popular in the field of letters. They were re-edited with commentary and notes by Florian; Bassano, 1860.

Even from a cursory survey of Roman science and medicine the figure of *Pliny the Elder*, the disciple and admirer of Cato, can hardly be omitted. Faulty and fantastic as is his *Natural History*, yet the man himself, and indeed his works, have their features of greatness. For folk-medicine he is our eminent source. Of his character we have a fairly full account in the *Letters* of his nephew. Pliny was evidently an amiable man who won the affections of those about him. In his ardent search for knowledge he was scarcely inferior to Aristotle, though he made a far worse use of his materials. If his style was ornate and rather careless, and his accumulations indiscriminate and uncritical—formerly I have compared them to the hoards of a jackdaw—and his quotations from the greek inaccurate, his setting forth, "his marquetry work," as Littré called it, has a certain Roman dignity; his phrases are concise, well turned and dexterous, his words are choice.[1] Ilberg thinks he was more critical than we are disposed to admit. He was high-minded enough to rebuke the gluttony and base indulgences of the wealthy Romans of his time—the time of such men as Clodius, Verres, or Lucullus; and in his end he was really heroic. Littré draws a pertinent comparison between Pliny's encyclopedia, of the age of Vespasian, and the *Speculum naturale* of Vincent of Beauvais, the chaplain of St. Louis. He notes, as one of the curious ups and downs of history, that Vincent's vast work had a prodigious success in the Middle Ages when Pliny had been forgotten; but on the revival of learning Pliny, as a pattern and as a fountain of authority, obtained even a greater vogue, while Vincent's folios mouldered on the shelf. Vincent was less original in mind—he drew largely from William of Conches—and less imaginative, than Pliny; he was drier, and more under the spell of antiquity.[2] On the other hand Pliny, in system and critical acumen, was incomparably the inferior of Celsus, and inferior even to Seneca. He had not the grip of principles, nor the sense of judgement and proportion which we admire in Celsus. Unchastened by the Ionian and Hippocratic reserve, Pliny's mouth was wide open for marvels and supernatural fantasies; though he denounced magic and magicians, in respect of medicine as well as of religion and prophecy. He was no less blundering, careless, and ignorant in his reflections on the Fine Arts (*H.N.* xxxv.); but the medical part of Pliny is the worst of his collection. His bundles of recipes, anecdotes, curiosities, metaphors, and prejudices are thrown together pell-mell without order, without interpretation. He was neither on the one hand an observer with some of the insight of a practitioner, nor on the other endowed with that quality and training of mind which enable some authors, even in the closet, to seize the true relations of groups of phenomena, to marshal them with some symmetry and mutual illustration, and to elicit from them the main principles of their development. He tells us that for the *Natural History* he drew from more than 2000 volumes; and his nephew informs us that his uncle, when Procurator in Spain, sold a pile of his commonplace books (*Electorum Commentarii*) to one Largius or Lartius Licinius for 400,000 sesterces (perhaps about £4000 of present value ?).

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[1] *E.g.* medicinae etiam avidus donec expertam damnaverit.

[2] Littré says (*H.N. de Plinio,* 1860) that V. of B. did not do justice to his own time: he did not mention the compass, gunpowder, nor sugar and silk.

Such must be the judgement to be passed upon the *Natural History*; upon Pliny as a man it should be more generous than it usually is. I have said that he was an amiable man; he was far more than this: he was a laborious scholar, an ardent pursuer of what he believed to be knowledge. A sedentary life, due to his incessant industry, in spite of the customary daily bath and massage, made him fat and pursy; but, thus far disabled as he was, his passionate love of knowledge impelled him to go forth to witness the eruption of Vesuvius, which trip was to his death. The whole of this part of his story, as told by the younger Pliny, is vivid and touching. Not only in his zeal for natural knowledge did he thus venture into peril, but his last hours in this crisis were honourable for personal intrepidity, and sanctified by his unselfish devotion to the safety of his companions and the rescue of fugitives from the blasted coast; unhappily in vain.

CHAPTER IX

SORANUS

In a previous lecture I mentioned, concerning obstetrics, the name of Soranus; in him, under Hadrian, twenty years before Galen, Methodism reached its zenith and thereafter began to wane.

Although *Soranus* was of the sect of the Methodists he was far too great a man to be enthralled in any sect. Galen, who angrily repudiated Methodism, yet spoke of Soranus with unwonted respect. The renown of this great physician, onwards through the centuries of Tertullian and Augustine to the Middle Ages, rested chiefly on his *Gynaecology*; but to confine his distinction to any one part of medicine would do him little justice. Soranus received his medical training in the later Alexandria, and was a great physician in all Medicine; a keen observer and an interesting person. A considerable part of his work on *Acute and Chronic Diseases* has survived, in the poor transcript of Caelius Aurelianus, a Numidian in Rome who knew little greek, and who lived 300 years later. We have also a treatise on Fractures (Bibl. Nat. Par. 92.2153), a MS. of the fifteenth century; and fragments of Soranus exist in Oribasius and in the Ἰατρικά of Aetius. Upon his gynaecology we will dwell for a moment, as upon this side of his work Ilberg has published an interesting essay,[1] a part of the large and scholarly work upon medical classics undertaken by the school of Diels.

The enormous ascendancy of Galen, his vast output in which he surpassed even that which amazes us in the writers on many subjects in the first two centuries of the Empire, his intricate and ardent dialectic which endeared him to the logicians and rhetoricians of his own and many later centuries, his teleological philosophy which endeared him to the Church, and above all the brilliancy and fertility of his genius, by overshadowing obscured and even effaced the traditions and documents of his predecessors. As Fielding Garrison has said, he had an answer ready for every problem, a reason to assign for every phenomenon.[1] Lost in the glamour of Galen, in the Middle Ages even the invaluable Celsus was forgotten. Galen whose gynaecology was not his strongest point, might have done better had he paid still more attention to Soranus. Not only so, but his animosity against Methodism threw all the work of this school into the greater neglect. Thus it was, as again in the time of the discovery of printing, that a turn of fashion brought destruction to many a precious manuscript. Yet if in the obliteration or neglect of his works Soranus was almost as unfortunate as Asclepiades, he was more fortunate in the upholding of his good name; in all later times he has been regarded as a great if half-forgotten physician. If then we have to appreciate the work of Soranus, we have not to refurbish his character.

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[1] *Die Überlieferung der Gynäkologie des Soranus von Ephesus*, von Johannes Ilberg (Leipzig, Teubner, 1910) (das xxviii. Bd. der *Abhnd. d. phil.-hist. Klasse d. K. Sach. Geschlft. d. Wissenschaften*, No. II. mit sechs Lichtdrucktafeln) was reviewed by the present writer in the *Class. Rev.*, March 1911. The appendix contains photographs of two pages of the Parisinus MS., and seven of the illustrations from the Brussels MS. of the uterus in normal and abnormal states of pregnancy. The preface is concerned with the Inter-Academic Corpus of Greek medical authors. Also, for unpublished positions of *foetus in utero*, see article by Sudhoff on Muscio, *Arch. Gesch. d. Med.* vol. iv., 1911.

Obstetrics and Gynaecology, for obvious reasons, took a leading place in ancient and medieval medicine. We know that the subject had a great vogue before Hippocrates, as in Cyrene, Croton, etc., and was studied and written upon by such physicians as Alcmaeon, Democedes, and Empedocles. The Hippocratic writings contain eight treatises on these subjects. Of the important work of Soranus on Gynaecology but little survives, nothing directly; but by a Cuvierian process of piecing together fossil fragments Ilberg in his acute and learned essay, has attempted, not unsuccessfully, to discern and to rectify some further part of the relics of Soranus concerning this subject. He decides that Soranus was no less excellent on surgery than in midwifery. Happily he was one of the best-robbed men of his age.

In the Bibl. Nationale is a manuscript, dating from the end of the fifteenth century (Parisinus graecus, 2153), of a kind of Handbook or Articella; a compilation without author's name, the middle or gynaecological part of which is a document of 67 leaves upon which is written in a rough hand, "Σωρανός ἐστιν." On the several attributions of the constituent parts of this handbook, which in the fifteenth and sixteenth centuries had a great vogue in the practice of midwifery, I cannot here dwell in detail; suffice it to say that their distribution has now become more explicit. The first critical edition of the Parisinus, by Dietz, was posthumously published, without the advantage of the editor's own revision, in 1838, as if it were the whole of it, from the Περὶ γυναικείων παθῶν of Soranus. But the part attributable to the master himself is really less than half of it. Ermerins did something to discriminate its contents, especially in comparison with those excerpts of Soranus which are embedded in the Sixteenth or Gynaecological Book of the Ἰατρικά of Aetius, a compiler of the sixth century as yet imperfectly edited. But the Parisinus contains additions, both of sentences and of chapters, which are significant as to authenticity, and are moreover of substantial importance; especially those on diseases of children, and on anatomy and physiology. The Aetius chapters on the other hand (xvi. 50-87) seem to have been, as it were, a canvas upon which certain "Soranea" were worked in.

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[1] *Journ. Am. Med. Assn.* vol. lvi., 1911.

The next important step in the reconstruction of Soranus was taken by Valentine Rose, who has fully discussed certain treatises of dubious origin and authenticity that have passed under the name of Soranus (see V. R. *Anecd. Gr.*). In the fifteenth and sixteenth centuries a certain latin book was familiarly known to obstetricians as the *Gynaecia Muscionis*. Its history is a curious one, for it is the latin form of it which proves to be the original work; the earliest known copy being an illustrated MS. of the ninth to tenth century now at Brussels.[1] The Greek rendering, under the fancy ("mundgerecht") title of *Moschion*, falsely supposed to be based on the *Genetia* of Caelius Aurelianus, and to be of the eighth to ninth century, is much later. It was the erroneous notion of its antiquity which Valentine Rose corrected in an able study (*Soranus*, 1882) wherein he proved the *Moschion* to be but a translation of Muscio, and—as *Moschion*—to have a pedigree not older than the fifteenth century; and moreover to be of very subordinate value. Many of the ignorances and errors of this "Graeculus" are set forth by Ilberg. In Daremberg's *Oribasius* (i. xxv.-xxvi.) I had underlined an allusion, with Moschion, to a gynaecologist named Metrodora. Daremberg said he had found a MS. at Florence under this name, and had copied it, proposing to publish it with other gynaecological works (*Theod. Priscian*, the "pseudo-Cleopatra" etc.). Some time later I lighted upon an article by Dr. Zervos of Athens,[1] who, in the course of his studies on Aetius, also discovered this same MS. (It is mentioned in Diels' catalogue, ii. 65.) Daremberg said the *Περὶ γυν. παθ.* of M. was but a collection of recipes; Zervos on the contrary, with testimony of extracts, speaks of this work as interesting not only as the first entire medical treatise by a woman, but, if of no lofty merit, at any rate a valuable enough record of personal observation and experience. No doubt, as is usual in all books of the period, it consisted largely of borrowings from other authors. It was probably of Ionian origin, but unfortunately it contains no definite evidence, external or internal, of its age.

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[1] *Bibl. Roy.*, 3701-3715. (Muscio occupies the second part of it.)

Of women doctors there seem to have been not a few both in Greece and Rome, chiefly midwives it is true; but by no means all. In Eur. *Hippol.* 293-6 the nurse says to Phaedra:

> *κεἰ μὲν νοσεῖς τι τῶν ἀπορρήτων κακῶν,*
> *γυναῖκες αἵδε συγκαθιστάναι νόσον·*
> *εἰ δ' ἔκφορός σοι συμφορὰ πρὸς ἄρσενας,*
> *λέγ', ὡς ἰατροῖς πρᾶγμα μηνυθῇ τόδε.*

("And if you suffer under some secret ill, the women are at hand to relieve the disease. But if your malady be one rather for the ear of men, say so, that the doctors may know.")

i.e. women undertook the more secret diseases. In Seneca (*Ep.* 66) the obstetrices are called "medicae."

On one inscription we find *μαῖα καὶ ἰατρός*; and on three we read of an *ἰατρίνη*; the name *ἰάτρια* was also in use. Neither of these designated a midwife exclusively. However, as we see, there were many male obstetricians and gynaecologists. How common women doctors, accredited or quacks, were in the Middle Ages we learn from the pages of Henry of Mondeville and Guy of Chauliac. Getting rid then of the Greek Moschion pastiche, it is on the Latin midwives' book that we are to fall back for such light as it may throw collaterally upon the Soranus from whose hands it was supposed to have come. To verify the Soranus relics these incidents had to be made clear.

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[1] Sudhoff's *Arch. Gesch. Med.* (iii. 141, 1910).

"Muscio" professes to have had before him two works of Soranus, a brief and catechetical, and an ampler work. He followed in the main the briefer and more didactic of the two, but also he padded out his rendering from the larger treatise. Soranus, in what we know of him, was prone also to be oracular (p. 125 *n.*), to utter aphorisms to be learned by rote; this we perceive in the substantial fragments of the *Acute and Chronic Diseases* preserved by Caelius Aurelianus. There are similar reasons to suppose also that, after writing his larger books, he drew up a book of Responsiones, or catechism.[1] Now, in these features of composition Muscio coincides likewise with Soranus, as we know him from other sources. The illustrations—the three unpublished foetus positions—probably belonged originally to the smaller or catechetical book of Soranus, and were reproduced to facilitate the abridgement. They have been carefully studied by many commentators, recently by Sudhoff,[2] because they seem to have descended to us from antiquity downwards through the Middle Ages.[3] In the sixteenth century they were skilfully elaborated, in the Rudolfi MS. of the Bibliothèque Nationale, by Primaticcio. Those of intra-uterine life probably came from Soranus himself. The Paris MS. has gaps for these; the illustrations themselves we have from secondary sources which strongly point to their being originals. There is no difficulty about the antiquity of such illustrations. The Alexandrians produced many which were taken forward, if I may say so, as "clichés."[4] Sudhoff carries illustrations back only to Alexandria, but at an earlier date Aristotle, in the *History of Animals*, refers to *σχήματα* and *διαγραφαί*. At a later date Galen seems to have produced diagrams (*ὑποδείξεις διὰ γραμμῶν*) of the muscles and nerves of the arm, and of optical phenomena. The illustrations in Soranus' treatise *Περὶ ἐπιδέσμων* pretty surely belong to the original text, and are comparable with the illustrations in those of Apollonius of Citium to the Περὶ ἄρθρων of Hippocrates in the same Florentine MS. (Laur. lxxiv. MS. of ninth to tenth century). Now in the Vatican is a well-known statue of a charioteer (in the Sala della biga) swathed in leather bands. These Helbig supposed to be reins gathered round his body; but from the Soranus illustrations we perceive that they were leather bandages to prevent injury to the ribs in a fall. The outcome of this further study of the Parisinus compilation Ilberg sums up as follows. Of the original date of it there is no evidence; the Byzantine physician put in nothing characteristic of himself or of his period. A tag from Meletius may well have been inserted later. It may have been written in the decadence of the seventh, or in the awakening of the ninth century. The anonymous author had before him in its two forms the work of Soranus—Περὶ γυναικείων παθῶν, and also the Sixteenth Book of Aetius; and these he undertook to blend into a new book. Passing over alteration of chapters, the scissors of the compiler were applied to what were probably four books of the original Soranus. Book I., though with some modification of form, he reproduced nearly in full. Book II. was also preserved, and its order better retained. Book III. was more destructively dealt with, and moreover, after the example of Aetius, suffered interpolations and corruptions. Book IV. suffered still worse things ("traurig ruiniert"); it was reduced for the most part to perverted scraps. On the whole, it would seem that the Aetius book was the framework of the compilation, and supplied indeed the greater part of it; and, as Ilberg remarks, compilers were far less scrupulous than transscribers.

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[1] Cf. the *Interrogationes* of C. Aurelianus. See Friedel's Edn., 1892.

[2] *Stud. d. Gesch. d. Med.* iv.

[3] Sudhoff, *loc. cit.* iv. 2, s. 109-128; two Plates. Also *Anat. im Mittelalter, loc. cit.* Hft. 4, 1908. Ilberg and Wellmann, *Zwei Vorträge z. Gesch. d. Med.* Teubner, 1909. H. Schöne's edition (1898), of that of the *Περὶ ἄρθρων* of Hippocrates by Apollonius of Citium (Leipzig, 1896), is a well-known and very interesting study of ancient surgical illustrations.

[4] See *e.g.* Sudhoff, "Med. Fachillust. aus der Antike in mittelalterlicher Uberlieferung," *Mitt. d. Deut. Ges. in Leipzig*, Bd. x. H. 5, s. 96. Also *Seventeenth Internat. Med. Cong.* 1913.

Up to the time of Oribasius the texts of Soranus seem to have been in fair preservation; so that from this valuable compiler many minor emendations and additions have been obtained. Probably Oribasius contains also more of Soranus, excerpts at present beyond identification; though some passages of a common Alexandrian tradition may have passed to Oribasius directly from Philumenos (p. 278).

Soranus as Physician and Surgeon.—Of the traditions that bound Soranus to the earlier Alexandria, one of the chief was the writings of Demetrius of Apamea, a disciple of Herophilus who flourished about 250 B.C., and whose teaching, especially in respect of etiology, Soranus cites with admiration. We have seen that it was the boast of the Methodists, especially of the more empirical section of them, that they looked only at what was before their eyes (μόνον πρὸς τὸ παρόν), for, in their opinion, to pry into causes led off to idle curiosity; while the only anatomy they required for clinical purposes (χρηστομαθείας ἕνεκα) was the state of constriction or relaxation of the tissues affected (χαλᾶν ἢ στεγνοῦν); thus for them immediate clinical observation was all in all, and normal physiology a matter of indifference. But it would have been surprising, Methodist as he was, if one standing in the following of Herophilus, and so back to the Cnidian and Alcmaeonic anatomy, should have accepted the arid universals of that sect, regarded necropsy as otiose (ἄχρηστος) and ministering to mere curiosity, and for like reason, dismissed the study of causes also. On the high authority of Ilberg and of Dr. Freeland Barbour [1] we learn that Soranus broke through the traditions of his school, turned back to Herophilus, and I may add to the outstanding Cnidian treatises on gynaecology, and in the teaching of the subject placed anatomy in the forefront. His knowledge of the genital tract in woman is, I think, overrated. His anatomy was of the animal uterus, and his description of the appendages is incorrect; but Dr. Barbour says "his writings bristle with facts." I remember Soranus says of the midwife that she must be dainty of her hands (τρυφερά). In many respects, no doubt, Soranus, as Galen perceived, was greater than his school. Still while the larger idea of molecular biology, and that of disease as a deflexion from the normal, were being degraded into the arid formulas of the later Methodists, a sterility which justly provoked the ire of Galen, we cannot say that Soranus shook himself wholly free from these shackles. He was, I think, more of a captive to those empty abstractions than Ilberg seems fully to admit; to the "κοινότητες" of *strictum* and *laxum*, mere phrases under which clinical diagnosis ranged no farther than the dilemma of suppression or flux, acute or chronic (στεγνοπαθοῦν καὶ ῥευματιζόμενον ὀξέως ἢ χρονίως). Still it is no less true that these views—these concentrations on the obvious—τὸ παρόν—did fasten attention upon the masterly clinical observations in which Celsus, Soranus, and Archigenes (Aretaeus ?) excelled. For example, if the study of phthisis in

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[1] Internat. Congr. Med., *Lancet*, Sept. 13, 1913.

C. Aurelianus be by Soranus it is a good piece of observation both in respect of symptoms and differential diagnosis ; it is far in advance of Hippocrates or Celsus. Moreover he points out that amelioration of symptoms is no cure ; and that very prolonged treatment is necessary to get the residual evil out of the body. Again, although rickets was known even to Hippocrates, it is as well described by Soranus as it was later by Galen. Ebstein dwells on this and discusses two ancient bones in the Museum at Syracuse—a thickened skull and a bent tibia—which show the effects of rickets.[1] Rickety bones were still recognised in the early Middle Ages. Certain fragments on nursery hygiene prove the skill and common sense of Soranus as a practitioner. The infant's bath is to be so graduated in temperature as to harden him. For six months he is to have milk only, mother's milk if possible ; after six months some breadcrumb or flour may be added, and a little honey. Then eggs and soup are allowed, and wine and water ; solid food being reached at ages between eighteen months and two years. He wisely urges that much farinaceous food should not be given at so early an age as was customary in Rome ; and he protests that too much alcohol was given to children. In the treatment of rickets which, I may add, was very prevalent among Roman children,[2] he orders that the child should not be tempted to walk too soon.

The capacity of Soranus as a surgeon we may recognise in his teaching on fractures and luxations, as preserved in Aetius and Niketas. His surgery was cautious and conservative ; he did not betake himself to operation until other means had failed. In Ilberg's words then Soranus " ist kein Toter " ; both in learning and practice and in loyal regard to tradition he stands on the heights of ancient medicine. His disciples were taught not only *claudere librum ut cogitent*, but also, and yet more, *ut videant et curent*.

It is in his therapeutics that the Methodist doctrines betray themselves unmistakably ; as in the ingenuity of local applications by which to command the permeability of the tissues of the parts affected.

As to the ethical attitude of Soranus, which was honourable,

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[1] W. Ebstein, "Über rachitischer Skelett in Alt. u. Mittelalter," *Virch. Arch.*, 1908, Bd. 193.

[2] See a paper by C. Séguin, *Progrès Méd.* Sept. 16 (?) (the year is not upon the slips I have by me—but probably about 1911–12). See also Ebstein, *loc. cit.*

Ilberg refers us to a paper of his own[1]—one to which I have not ready access—on the decision between the life of mother and child φθορά as illustrated by the maxims of Soranus recorded by Aetius.

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[1] "Zur gynäkologischen Ethik der Griechen," in the *Archiv für Religionswissenschaft*, xiii., 1910.

CHAPTER X

PNEUMATISM

We have associated atomism with Asclepiades and the Methodists, of whom Soranus was the last and greatest: we have now to return to consider another and a more ascendant sect, that of the Pneumatists, and the idea and doctrine of the Pneuma. Amid the manifold modes and sects of Roman medicine I must concentrate your attention at somewhat greater length upon Pneumatism, because, among other qualities of interest, such as the ascendancy of ideas and the comprehension of psychology in physiology, its central idea seems to me to have been the dawn of what I have elsewhere and formerly ventured to describe as the pathetic quest for oxygen.

To set forth the doctrines of Pneumatism from the primeval sources to its issues, chronologically and with due regard to its several exponents, would within these limits, be impossible. I must try to be succinct in my sketch.[1] The pneuma, as an idea, we have followed in the successive generations of Thales, Hippocrates, Aristotle, Erasistratus, Athenaeus, and Galen: from Alcmaeon again through Heraclitus we have seen it emerge as knowledge from myth and as logos from breath. When the sect of the Pneumatists was waning we found the idea again in Aretaeus; whence (pp. 68-69) it passed, with teleological qualifications, into the Stoic creed, and was adopted by Galen as denoting a fiery and intelligent divine activity pervading macrocosm and microcosm. Passing over the extravagances of John the Actuary and other Byzantine authors, we find the pneuma onwards and in new guise as an answer to the amazing riddle of the origin, growth, and propagation of living things. We recognise it again in the Archaeus of van Helmont, and in the writings of Stahl and Hoffmann, and follow it through these later centuries under various names, such as the "impetus faciens," "causa efficiens," "aura genialis," "spiritus seminis," "spiritus rector," "mysticum spiramen," phlogiston, caloric, vitalism, vital principle, growing impulse, even "*élan vital*," as an internal guiding force, and so forth; until on its physical side, it or part of it, was ultimately run to ground as oxygen.

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[1] I would acknowledge the debt that, in common with all students of the subject, I owe to Wellmann's Essay, "Philologische Untersuchungen," xivtes Heft, *Die Pneumatische Schule bis auf Archigenes*, von Max Wellmann, Berlin, 1895. See also his *Sicilian Fragments*. However I have used many other contributions—*e.g.* Jäger's art. on "Pneuma," *Hermes*, xlviii., 1913—and trust that, although without that of Wellmann my own work would have been defective, it may be substantially more than a reproduction of Wellmann.

We must distinguish then the history of the sect from the history of the idea, because as a sect the phase was brief; after the second century it had ceased to exist by name, and in its doctrines had lost consistency; the idea on the other hand was, and is, one which in manifold forms has dominated and inspired the minds of men beyond the dominion and beyond the inspiration of any other idea in physiology; and this moreover with a fervour which has penetrated far beyond the limits of the biological sciences. Indeed to-day as we utter the word *inspiration* we still feel the glow of the spirit which, from the ancient legends of the creation of life to the messages of our modern ethereal telegraphy, from the hauntings of the Great Spirit in primeval man, through the storms of superstition, to the haven of the soul in its purest communion with the Divine, has moulded the whole story of man and embedded itself in his tongue. Yet we shall observe again nevertheless in the history of this, as of all other spheres of thought, how a living idea gradually becomes so imprisoned in the letter that its liberty is enthralled in its own formulas. Thus as the brilliant Ionian atomic hypothesis dried up into the arid formulas of the Methodists, as Hippocratean wisdom into Dogmatism, as Empiricism into mere rule of thumb, rational scepticism into Pyrrhonism, so the idea of the pneuma was cribbed in the sectarian Pneumatism.

The origins then of the idea known for a while as Pneumatism are lost in the backward of time. The soul itself was an air (pneuma, πνέω) or vapour. Aetius said truly that by Anaximenes (pp. 90 and 114), air, pneuma, and wind were used synonymously; then gradually spirit detached itself as a vital principle, as in Anaximander and Demócritus. He asks, if air and pneuma be one concept, how or where the element of agency comes in? In sacrifice the steam of the blood appeared to the earlier folk as the exhalation of the animal's soul, a notion which long persisted. That the pneuma, at first regarded as an exhalation from the blood, but at a later date regarded as, if not in part constituted, yet at any rate nourished by a *sanguis halituosus* (ἀναθυμίασις), was a belief that survived more or less in the doctrine of Aristotle himself. On the celestial side Mr. Barnard Cook says that the goddess, originally in bird form, which escaped from the cleft skull of Zeus may be regarded as his "soul."[1] And from Zeus we pass immediately to Ether (αἰθήρ), or ethereal essence.[2] As a modern commentator has put it, "Die Seele, ein Teil des feurigen Gotteshauches."[3] This primordial essence (Zeus, aither) to which on its release from the body the spirit returned, underwent an early division into active and passive, into primary force and primary substance, the conjugation of which opposites played a large part in later philosophy, without as well as within pneumatist circles. And so gradually the dynamic conception developed into many qualities; though indeed by some schools the pneuma—if I may anticipate the use of the word—had been imagined as a yet more primeval substance (Urkörper) out of which, when fertilised by a seminal principle (σπερματικὸς λόγος), particulars emerged. So in phase after phase the idea of the pneuma began to contain more than the several notions of air, of vapour, of fire, or fiery vapour. Bacon (*Hist. densi et rari*) says "The spirits of vegetables and animals are compounded of an aery and flamy pneumatic body"; and proceeds to speak of this as universal in matter, more or less as degrees of heat. Whether of incorporeal or corporeal particles, in later times spirit became a world force; or with some even a living divine reason

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[1] See his work on *Zeus*, Camb. Univ. Press, 1914, i. 31. Also *Class. Rev.*, May 1905, p. 81. Primitively, in both sexes the souls were regarded as female: *e.g.* Sirens, Harpies, Eumenides.

[2] Some twenty-five centuries later, Sir Oliver Lodge—*Times Lit. Suppl.* Jan. 9, 1919, writes that in his view "the soul will turn out to be a sort of ethereal body."

[3] Some of the Stoics, *e.g.* Zeno and Posidonius—for whom pneuma—divine spirit—was ἀρχή—regarded God also, or at any rate the governing heavens, as a fiery element surrounding and penetrating, rather than constituting, every other kind of matter; as in the Book of Genesis the Spirit of God *moved upon* (ἐπεφέρετο ἐπάνω) the face of the waters. We may be rather surprised to find the quickening leaven of the pneuma, though with some considerable peripatetic infusion, so actively at work in association with the Stoics, for whom all emotion was a perversion or a defect of virtue. This inconsistency was not only felt by such later Stoics as Panaetius and Posidonius, but became a subject of apologetic.

(*ζῶον ἔμψυχον λογικόν*). Alcmaeon thought all divine essences, like the celestial bodies, were in, or actually were, perpetual motion.

But I will pass quickly over much of the interminable Pneumatist and Stoical dialectic, worthy of medieval times, recorded later by Sextus Empiricus, Diogenes Laertius and otherwise, as to the modes of generation from the primitive units: how, on the dominant idea of generation, earth and water were passive substances (*παθητικά*), fire and air (*δραστικά*) powers (*δυνάμεις*), and so forth; over much logic also about fire, heat, air, and pneuma, about rarity (Zeus) and density; about heat in organic and inorganic bodies respectively; and how far—and this is most interesting—fire (or pneuma) was not always a separating or dissolving agent, but, as in the technical arts (*θερμὸν τὸ ἐργαζόμενον*) might fuse, temper, construct, and modulate (make rhythm); passages which recall to us the lofty vaunt of Prometheus—

> . . . in the fiery flame that lends
> Its aid to every art.[1]

Still greater marvels could it do in the hands of Nature, the supreme artisan, using fire both as a tool and as a material.

Fire then might work either as an element (or substance—*ὕλη*), or as a tool (*ὄργανον*).[2] And if by some thinkers pneuma was regarded as a kind of fire, by others, as in the later treatise Περὶ *πνεύματος*, it was regarded as a fifth element or "simple" (*ἁπλόον*); in either case, by the various mingling of the elements and the formative fire in the physiological smithy, the several main tissues of the body (*ὁμοιομερῆ*),[3] that is, bones, flesh, blood-vessels, etc.; as in handicraft the supplies of wood, iron, etc., were evolved and maintained.

In the later and clearer definitions air and pneuma became distinct from soul (*ψυχή*), at any rate for many philosophers or physiologists; and from *Nous* (p. 120) which for some included the faculty of reason, but for others did not. For Aristotle the soul became the origin, prime agent, or principle of motion; pneuma being its organ. In his system the breath took a subordinate place, indeed in this context pneuma became nearly identical with *Nous* as conceived by Anaxagoras, an energising and ordering reason, a principle or guide of development; no metaphysical abstraction but a physical thing, a finer matter (ether) vibrating in and through all things, but most vividly in living things. But in Anaxagoras *Nous* was not, as in Aristotle, teleological; but simply a "differentiating and integrating agent" (Benn). However, as being in "conciliation with nature," its works might be interpretable teleologically; and partly in this connexion it was that in later times Pneumatism became allied to Stoicism, an alliance at first sight unlikely, as one without radical coherence; but Stoic physical teaching was indeed, as a whole, lacking in consistency; rather an eclectic array, a syncretism for pragmatic ends, than an organised natural philosophy. Notwithstanding it found a place in such works as Seneca's *Quaest. nat.*, and so on into the Middle Ages. So in the same way atomism was no essential part of the methods and ends of life as proclaimed by Lucretius. Aristotle's successor, Theophrastus, regarded pneuma likewise as to quantum congenital, and the soul as working the pneuma; this, it is true, was one view of the Hippocratean school also, a tradition to which Aristotle had been much indebted. Straton, also an Aristotelian (p. 140), gave a still more dominant place in physiology to the pneuma as a carrier of the psychic function, or soul; and supposed it to enter the foetus by the semen. Still for him also pneuma was thus not inbreathed; in his view the respiration served entirely for that cooling of the innate heat of the heart which for the Lyceum was its general function. However, as I have said, to follow all the windings of this psychical dialectic would be an endless and unprofitable labour.

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[1] ΧΟ. *καὶ νῦν φλογωπὸν πῦρ ἔχουσ' ἐφήμεροι;*
ΠΡ. *ἀφ' οὗ γε πολλὰς ἐκμαθήσονται τέχνας* (Aesch. *P.V.* 253-4).

[2] See the pseudo-Aristotelian treatise Π*ερὶ πνεύματος*.

[3] On the homoiomeria, or specific kinds of structural units, of Anaxagoras and others see Lucret. i. 830 *et seq.* and these lectures (p. 108).

In the history of opinion we have to beware not only of shaping the opinions of the past by our own, but also to take heed lest, while thus detaching ourselves as critics, and desiring to attribute to each of our ancient forerunners just his own uncoloured ideas, we discriminate them with qualities to which he was a stranger. The ancients had not distinguished, disentangled, or differentiated concepts, or principles, so as to argue within and around them with the precision and discernment of later generations. In those times ideas were not so much mingled as inchoate, and still implicit together; their rudiments had not extricated themselves and recombined into separable strands. Ideas were nebulous, approximate, and blended. Logic came afterwards, only too soon, only too systematically; for many a century to deprive the earlier speculations of their spontaneity and of their naïvety, while masking behind its wire grille the vacuity of fact and the lack of verification. The late Professor Beare said that even Aristotle's psychology is often too vague to get hold of, even when the preceding philosophical opinions have been set forth. Our great ancestors could not get at the facts of psychology, hard as Aristotle tried to do it: but they did relate it to physics and physiology; they studied knowing as a property of "matter." "The question of real existence outside sense came centuries after Thales" (Beare). Although now we have not only penetrated into minuter detail, and thereby gained some idea of nature's realm of the infinitely little, we have humbly to admit that in respect of psychology we are as yet but playing on the shore.

It is to Galen, whose value as a source of medical history cannot in our dearth of sources be over-estimated, that we owe most of our knowledge of the sect of Pneumatism in its more developed doctrine. Our knowledge of the system is also enlarged by a pseudo-Galenic handbook, Ὅροι ἰατρικοί, supposed by Rose and by Diels to represent Athenaeus, as it observes his arrangement; but, being of later date, probably of the third century A.D., it contains more than this, and throws some light upon Agathinus, Archigenes—of whom I have much to say hereafter—Leonides and Heliodorus; this treatise, after the manner of the second century, is a fusion or tesselation of pneumatism, methodism, and eclecticism. It deals also with the pulse lore with which, as we shall see, the pneumatists made great play.

On account then of the aforesaid multitude and confusion of terms, such as pneuma, soul, air, breath, innate heat, principle of motion, etc., it is the more difficult to trace the idea of the pneuma in the several schools to its sources. *Atma* in the Rig-Veda means, I am told, breath, life, soul. We have seen that among the free people in Greek lands the idea of *pneuma* began as a conception in the dim dawn, as a blend of religion (orphism), philosophy, and science; and in the Chapter on the Ionians we have seen that the great achievement of the pre-Aristotelian period was the conception of a cosmos expressive of number and law, as contrasted with myths of a creation animated by the caprices of a rabble of subterranean or celestial gods, or determined under drifts of chance. Zeller has admirably pointed out how high and original was the thinking that all this idea of cosmos, indeed the very name "Cosmos" itself, signified; and how independent it became of Oriental and Egyptian influence. We saw, moreover, that evolution, conceived on the boldest intellectual lines, was founded by the Ionians on an atomic hypothesis, on an axiom of the indestructibility of matter and force, and on expansions and condensations, attractions and repulsions, original in a primary element—such as water (Thales) or air (Anaximenes). In the mobile air, or in the evaporations of water, or in the exhalations of the juices of plants or animals as seen, for instance, arising from the stream of fresh blood in the sacrifices (p. 226), was recognised a primordial essence, substance, or dynamic stuff, the source of energy and life, from which by differentiations all things came into being, and by a reverse process were dissolved.

As we have seen, it is convenient to divide the history of the Pneuma into two periods:—the period before Aristotle, a period in which we may take Empedocles and Democritus as our examples—for in this respect Empedocles was independent of Pythagoras—and the period of the great master himself, and his immediate disciples. After them the doctrines of the Alexandrian school onwards established a tradition which followed a remarkable course. The logical terms air, fire, pneuma, soul, nous, and so on, confused in the earlier time, in the later were compared and distributed more or less, and yet again re-integrated; for the later Stoics regarded pneuma as the whole soul of man and animals, indeed of the Cosmos.

We shall find indeed that the division of the history of the "spirit" into pre-Aristotelian and post-Aristotelian periods is something more than a mere convenience of date; it marks the divergence of two main periods of the relations of science, philosophy, and religion—Orphic and other;[1] periods marked by the stages, or the schools, of Empedocles, the Coans, Democritus, Plato; then of Aristotle, Chrysippus, and Alexandria; and thereafter of Paul of Tarsus, Athenaeus of Attalia, Philo, Origen, Basil. For example, Val. Rose pointed out that in the unmoved mover (the moving part and the fulcrum, p. 113) the fulcrum, the immovable principle, was a metaphysical or spiritual rather than a mechanical idea. The soul was partly moved, partly at rest ("fulcrum"). It was in the unmoved that the active soul or Will-agent (*ὄρεξις* or *τὸ ὀρεκτικόν*, or *ἔρως*—our fashionable *élan vital*) had its source. For Aristotle the pneuma was only the organ of the soul (p. 227); yet for him the coupling of aesthesis and kinesis—the common functions of body and soul (*κοινὰ σώματος καὶ ψυχῆς ἔργα*)—became psychological; (see First section, *Parva nat.* and the Περὶ ζ. κ.); thus points of comparison were made on which we pass from the mystical to the scientific.

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[1] See also Diels, *Vorsok., et aliter*; Wellmann, *Frag. d. S. Ärzte*, Berlin, 1901; Capelle, "Auf Spuren alter *φυσικοι*," *Hermes* xlv. 3, p. 321; and Jäger's art. in *Hermes*, 1913. It should be stated that Jäger's line of argument rests in part upon the assumption that the Aristotelian treatise Περὶ ζώων κινήσεως is authentic.

Our modern religious or highly ethical connotations of "soul" make the word *psyche* almost untranslatable; "vital principle" is inadequate, plants have a vital principle; it is when from this principle "the desire of activity (*ὄρεξις*) springs up in the heart that psyche begins to emerge." Before the time of Plato soul and body, or mind and body, were not sharply distinguished; unless perhaps in a vague animistic or daemonic sense, soul was not conceived as a persisting identity of personal consciousness. Indeed the word *psyche* passed through five phases of meaning: (1) it meant only air or wind, and thence breath of life (*anima*), that which escapes from the body with the blood (Homer), and is dissipated; or, as a chthonic libation, would put life into ghosts: (2) soul or spirit (*animus*)—first in Herodotus: (3) including *θυμός*—will, soul, heart, and even appetite: (4) the organ of *nous*, continent of (*Timaeus*) all relations of number, measure, and creator of harmony and order; (5) the *anima mundi*, and the immortal psyche of man. Paul of Tarsus, as Plato had done, divided our nature into (*a*) *Pneuma*, or sometimes *nous*—divine reason and immortal (as in *Phaedo*, and Rom. vii.); (*b*) psyche, the life principle of the body and perishable; and (*c*) *soma* or *sarx*: "the sword of the Lord pierces asunder the soul and spirit" (*ψυχῆς καὶ πνεύματος* Heb. iv. 12 [1]). The notion of real existence outside sense arose slowly and almost imperceptibly;

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[1] In 1 Cor. xv. Paul speaks of the first Adam as *ψυχὴ ζῶσα*, of the last as *πνεῦμα ζωοποιοῦν*; so that pneuma for him meant the Holy Spirit breathed into the animal psyche. Thus *ὁ ψυχικός*, the natural man, seems here to be *ἀρχή* (original), pneuma an addition or development, and *πνευματικός*, the spiritual.

and that of soul as a supreme minister in the sphere of ethics did not fully develop till sometime after Paul, say in the fifth century. In Virgil *anima* seems to be equivalent to psyche, and to be a portion of the world's breath of life. In Lucretius it seems to return towards the sense of mere vital principle; *e.g.* "*prius . . . quam prolapsa foras enaret in aëris auras.*" (iii. 606; and see also l. 581). For the Parmenidean Telesius (A.D. 1508–88), *anima* was (in animals) the general feeling or aesthesis; it governed the whole body, and entered with the serum. The *anima* of plants was a little denser than that of animals. Heat in his opinion was seated in the uterus; pneuma, a parcel of finest air, in the cerebral ventricles (p. 252). *Animus* always signified soul plus the thinking faculty. Albeit both words originally meant air or breath (*ἄνεμος*); though always on a plane above the vegetative principle.

Furthermore, we must not suppose that the pythagorean doctrines and mysticism, ancient as they were, were soon forgotten, or even went out of fashion. They had great influence over Plato, and the earlier Lyceum; and these doctrines were still read and followed down at any rate to the first century B.C. The learned Nigidius Figulus,[1] Cicero's friend, was an ardent Pythagorean. Thus Plato was a dualist after Pythagoras; he regarded the intellectual soul as an immortal resident in the body (the brain), its tabernacle; below it were an emotional psyche in the breast, and an appetitive in the body. Much the same of the highest soul and of the under kinds may be said of Aristotle. This dualism was opposed by the Stoics, for whom the newer concept of human reason, as part of the divine reason, was supreme.

Another considerable step in medical pneumatism was the fusion or adaptation of the dynamic idea with that of the four elements, or radical substances (*ῥιζώματα*), of Empedocles, adopted by Plato through the mediation of Philolaus—fire, air, water, earth—termed the *τὰ ἁπλᾶ* or rational units, the creative qualities of which (*ποιότητες*) were hot, cold, moist, dry. And here we find ourselves again at a main parting of the ways; a break between Aristotle and his direct forerunners, when the four elements and the constructive principles of Aristotle's physiology were taken from the Sicilian school: especially the idea of the heart as the seat of the psychical pneuma; whence followed its supremacy in the body, the origin and combination of movement and sensation therein, the doctrine of innate heat (ἔμφυτος θερμασία), and above all the notion of respiration as a cooling process, and its fall therefore to a secondary animal function; the innate heat (σύμφ. πν.) being explicitly not derived from without (ἐπείσακτον), but from the mother's womb: the quantum also being congenital. It gave life, quality, individuality. The embryo had its vegetable soul (φυτοῦ τρόπον) which developed the protoplasm into limbs, viscera, and so forth. Empedocles however, for whose physiology, congruous with the *Timaeus* but in some distinction from Aristotle, congenital heat (ἔμφυτος θερμασία), became essential, seems to have regarded the embryo as, if not lifeless, yet but potential (ἄπνουν ζῶον) until it breathed, and so took in an airy auxiliary from without (ἐκτὸς ἀερῶδες, p. 254).

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[1] Publ. N. Figulus, *Op. reliq.*, Wien, 1889.

As to the channel of this Sicilian influence upon Aristotle, we have seen that Diocles and the Italo-Sicilian *Philistion* of Locroi (p. 135) held like opinions; now Philistion may have known Aristotle in Athens: but before Aristotle we perceive the Italo-Greek influence in Plato (*Timaeus*, etc.). On the other hand in all this matter Aristotle was as far from the later Empirics as from the Stoics, for whom, as I have said, pneuma, as a fiery principle, was a manifestation, and indeed a portion, of the divine creative spirit, the thought and power of the universe. He seems to have regarded pneuma, to which however he did not pay much heed, as a vapour of indeterminate nature (p. 226) produced in the body. He did not trace air to the blood, as Galen did in the "spirituous blood"; nor to any tissue or system of the body as did Erasistratus to the arterial system.

If these preliminaries seem long, and I fear tedious, I must be forgiven, for in respect of the origins of biochemistry they are very important.

To return to the air: we have seen that the early philosophers—Anaximenes certainly and probably Heraclitus—by air meant no doubt just air only (pp. 90 and 114); but for them air was an unsubstantial, immeasurable, impalpable, and infinitely subtle agent, having nevertheless degrees of potency according to its condensations and rarefactions; some highly etherealised part of it—its essence as Galen afterwards expressed it (*ἡ οὐσία αὐτὴ τοῦ ἀέρος*)[1]—its oxygen as we should say—being subtle and potent, and working in the manner of combustion: a remarkable conception, in later times darkened by cruder notions. To come now a little nearer to physiology: for the early Greek thinkers pneuma or soul had its tides in the respiration. *Inspiration* is just air in motion: but what air? What of air, or in it, can be fraught with creative power? What ethereal agent can endow the tabernacle of clay with energy, life, motion, and thought? In expiration the soul went out, making touch with the universe; in inspiration it returned with *logos*, enriched and able to dispense knowledge. Then the ingoing logos manifested itself as speech, the essence of speech being the formulation of the essences of things as perceived by the senses—a communion of microcosm and macrocosm. We shall comprehend the idea better perhaps if we translate logos as *expression*, and take as our instances the works in which, and through which, a creative artist—a sculptor or painter for example—expresses himself. How this transcendental theory of the *logos* persisted through Greek, Alexandrian, Roman, and Hellenistic times is common knowledge. The "triad" of Plotinus was: (1) Psyche, the soul or principle of life; (2) Pneuma, spirit or logos; (3) Transcendent being. A saying of Laurence Oliphant is worthy of remark, that here—"The sense of union with Christ, of His living in us, was manifested, or became perceptible, in a physical sense, chiefly in changes of the natural respiration." In a very interesting paper read by Professor Sir F. Mott before the Society of English Singers (see *Brit. Med. Journ.*, 1915, p. 845) the author described his investigations from the emotions upwards to their influence on the breath; and established a continuity and meeting-place of psychical and physical forces in the breath.

We must be careful then to distinguish, where from time to time there was confusion, or at any rate a blend, between pneuma as intensely dynamic, as an absorption from without of a subtle or fiery air—a substance no doubt, as for these ancient thinkers most concepts or abstractions were entities; a substance moreover nourished, or at any rate restored, from a perennial source, as from the infinite (*ἄπειρον*), or from the atmosphere, or from "anathumiasis" (p. 226)—and pneuma as a congenital constant,[1] and more occult agent; perhaps as "form"; or, more materially still, as a moulder of growth and active nutrition; the ψυχὴ θρεπτική, αὐξητική or γεννητική of Aristotle. It is interesting here to compare the words of a modern biologist. "In many cases, at any rate, the body of an embryo is not, like a picture puzzle, a mosaic of pieces each destined to form a particular organ, but consists of sheets of indifferent material 'without form and void' on which a formative 'something'" (like the *Nous* of Anaxagoras) "works, and evokes the beautiful detail of the adult structure. As Driesch has expressed it, 'Ein jedes jedes kann.'"[2] It was a little later, as differences were perceived, that spirit was formulated into the three well-known kinds: the vegetative, the animal, and the psychical. "Who wonders not more," says Sir Thomas Browne, "at the operation of two souls in those little bodies (ants and flies) than but one in the trunk of a cedar?" "The vital is begotten of the purest heart's blood, and conveys the glow of life through the other members, which gives them all the capabilities of action which emanate from the heart's vitality, the arteries serving for the transmission of this spirit to all the members"—

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[1] Yet in another sentence he says that animals are suffocated not for lack of this *οὐσία ἀέρος* but of something else (*ἄλλο τι*). Of pneuma he says that the heart needs not its substance but a certain quality of it (*ποιότης*).

> Spiritus intus alit, totamque infusa per artus
> Mens agitat molem et magno se corpore miscet.
> *Aeneid* vi. 726-7.

Thus it came about that in some periods, some writers, and some schools, as in the Lyceum, we lose the idea of *combustion*, or at any rate sight and distinction of it, in the *Vis plastica*, the *Vis vitae formatrix*; as in later times conceived again by Paracelsus and others. This attitude of thought we have already noted in Philistion and Diocles, when they saw one main source or entrance of this energy in gastric digestion—for Philistion the pneuma was indrawn also by the pores all over the body—onwards through Aristotle to Harvey, for whom also heat was an implanted entity; or, as Aristotle and others supposed, an entity inherited both as to *quale* and *quantum* once for all (*σύμφυτον*). Other physiologists supposed also that this heat must somehow be fed; but by those who regarded heat strictly as an "innate" constant, this problem was not greatly considered; it was verbally met, and meanwhile was too obscure for immediate attention. But we have seen that the ancient idea of *ἀναθυμίασις*, of exhalation of pneuma, or at any rate of its food, from the blood and juices of the body, long survived; though in a more and more indefinite form. The belief long prevailed that the foetus in utero both fed and respired by its mouth. Many Hippocrateans believed that the pneuma was to animate and to feed the heart; and some indeed conceived that the respiration made heat as does the air in a stove. It was those who dwelt more on the originally airy quality of pneuma who began to store it in the arteries, or in the "nerves."[1] That representative philosopher Diogenes of Apollonia (p. 109) in the fourth century B.C., had conceived, or carried forward, the idea of thought as a universal bodily function fed by the air in the blood-vessels. However, the author of the treatise *De spiritu* (*Περὶ πνεύματος*) to which I have referred, did consider the question of the nutrition of the pneuma curiously; and pointed out shrewdly enough that nutrition, in the common sense, must assume the pre-existence of pulsatory and respiratory function. Much later, at the beginning of the second century A.D., we find Soranus saying that the *blood and pneuma* were prepared in the blood-vessels for the nutrition of the embryo (*δι᾽ ὧν εἰς θρέψιν ὕλη αἱματικὴ καὶ πνευματικὴ παρακομίζεται τοῖς ἐμβρύοις*), not in the semen (Diels, *Vorsok.*).

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[1] As regards the two adjectives ἔμφυτος and σύμφυτος, ἔμφυτος is usually taken to mean *innate*, congenital as in the ἔμφυτοι ἔννοιαι,—"innate notions" of the Stoics. Σύμφυτος may mean *inbred*, but also *grown together*—*concretus*, *compositus* = fused into one: *e.g.* πέρας καὶ ἀπειρίαν ἐν αὑτοῖς σύμφυτον, Plato, *Phil.* 16 c. But I am told on high authority that in the contexts before us these adjectives are identical in meaning, or cannot be distinguished.

[2] Prof. MacBride, *Proc. Roy. Soc.* B. 630, 1918.

The pneumatists proper, the sect as established by Athenaeus, may be said to have identified pneuma with innate heat, as Aristotle had virtually done; and, following Aristotle and some of the Hippocratic authors, to have accepted the heart as the seat of it;[2] the heart thereupon being the governor of the life of the body, the seat of passion and even of cognition (*ἡγεμονικόν*). Thus on its psychical side pneuma for them seemed almost to contain the peripatetic principle of *nous*.

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[1] For the early anatomical confusion of empty artery, sinew, and nerve we have to make frequent allowance.

[2] The main doctrine of the Hippocrateans described the brain as the seat of the intellectual soul. Aristotle did indeed recognise the sympathy between the heart and the brain, and that the brain was the seat of three of the special senses. In some passages he almost admits that the brain may be the seat of the reasoning faculty.

By some early sages the respiration was so subtilised as to have become for them an epiphenomenon—a function of the bloom, not of the essence of life. Democritus knew better than this; and so of course did Aristotle, Anaxagoras, and Diogenes of Apollonia, all of whom held that even fishes breathed somehow by the gills which exercised a kind of suction such as to attract air contained in the water.[1] But as for fishes, and all animals inhabiting moist places, water was a cooling jacket for the innate heat, respiration was of little importance.

As regards the function of the breath and respiration let us return for a moment to the rapturous idea of flux revealed by Heraclitus. Worlds away was his rushing, teeming, manifold, many-coloured torrent of life, his sense of strife as the key-note of development, from the grey motionless shadows of the rigid Parmenidean unity. As Mr. Benn has said, at Elea all becoming was absorbed into being, at Ephesus all being into becoming. Thence on these subtle airs we drift down by the Hippocratic Sicilian tradition to the *Timaeus*. William Ogle pointed out that as Plato borrowed his physiology from Hippocrates he may be said to represent the views of the most prominent authorities immediately antecedent to Aristotle. So indeed Galen says (*De usu part*. i. 8); but it is difficult to be sure of Hippocrates's ideas of respiratory function, which we can only surmise from Galen's report of it as " nourishment and cooling "; *i.e.* fuel and a damper. However, from these and other sources, we know that the whole apparatus of breathing was regarded by Plato as independent of the primary animal organisation; that the " zoon " was already " plasthen "—had taken shape—when this dynamic function was added to it.[2] The structure of the whole body being pervious to both air and fire, fire, as the most subtle of all created things (*πάντων γενῶν σμικρομερέστατον*) drove the air through its pores (*διὰ μανῶν τῶν σαρκῶν*), an allusion to the early idea of respiration through the pores of the skin,[3] like the *respiratio mundi* of the macrocosm; a doctrine at least as ancient as Empedocles, probably older. The insight of

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[1] More than one ancient physiologist, including Galen, supposed a solution or absorption of air in water; but it was Bernouilli (in 1690) who showed that fishes could not live in boiled water; and that these animals "aërem ab aqua secernunt" (pp. 111 and 248).

[2] *Tim.* 78 c etc. For this argument, body, matter, or substance is most readily defined as resistance—inertia; that which lay between "void" on the one hand and "form" on the other.

[3] See Galen, Kühn v. 266 and 709, and other authors before and after.

Heraclitus we have seen in his teaching that animating fire (*πῦρ αἰείζωον*) is not to be identified with fire as visible to the eye as flame, but is far subtler, always in motion, and penetrating and vitalising everything (p. 114). This doctrine governed the ideas of Plato and Aristotle, and almost all later ancient authors.

Without going tediously into detail, Plato's conception (*Tim.* 78) was of a double cage of net or wicker, the outer containing air, the inner containing fire (as if it were cages of carbonic acid and oxygen) with inlets to the bodily orifices, so that those agents by alternate inflation and depletion (*ἐκπνοή* and *ἀναπνοή*) should palpitate through the body.[1] We start full; then the air, heated by the fiery envelope, drives by the nearest way through mouth and nostrils; then again, to avoid a vacuum, comes a compression (*περίωσις*), so that the air escapes through the tenuous interstices of the flesh (inspiration), and onwards by oscillation (*αἴωρα*) through the blood-vessels (*φλέβας*) and the cavities (*διὰ τῆς κοιλίας*): "making its course from the inwards to the parts extreme." Thus the body lived and was fed, was watered and cooled. Plato surmised that the outward drive of expiration made a vacuum, so that the surrounding atmosphere rushed inwards, like the draught following a motor car; or these tides were regarded as more or less of the same kind as the flux and reflux of the blood mass, an oscillation inherent in the nature of such systems. The corpse differed from the plastic but not yet breathing body in that both soul and "form" had escaped to their refuge (*ὑποδοχή*), and left the "matter," which they had temporarily impressed, inanimate. "To die is to be a counterfeit; for he is but the counterfeit of a man who hath not the life of a man," said another authority. Yet to regard spirit as expanding, shaping, and disintegrating an inert matter is a lower idea than the earlier Ionian conception of matter and energy as one. However, such in rough outline were the prophetic contemplations of these earlier thinkers upon that primeval miracle the respiration, the inhalation of life from the invisible circumambient ether, essence, air, spirit, soul. "And He breathed into his nostrils the breath of life, and man became a living soul."

If then to attempt to carry into the dynamic speculations of early natural philosophers our specific knowledge of oxygen, or of any gas other than air, would of course be a foolish illusion, yet for the Ionians we may claim notwithstanding that they did conceive the idea of combustion as a source of energy in animals, and attributed it to a certain fiery quality of the air; an idea which, by condensation into the formula of the "innate heat"—*i.e.* in effect uncaused heat—which possessed Aristotle and consequently Harvey, was more or less sterilised. Diocles, in supposing, after Empedocles (*Frag. Sic.*), that the pneuma entered in part by the stomach or was generated there (p. 136) had the insight to perceive that animal heat, although called "innate," yet had its causes, and that these lay more or less in the physical begetting of heat in pepsis and "coction." However, by fermentation and coction came chyle which the liver, like the spleen also a hot organ (Gal. *De part.* iii.), elaborated into blood and pneuma, the pneuma passing mainly to the left heart; a doctrine which was a development of the "anathumiasis" of their forefathers. Contrariwise, Aristotle objected that digestion presupposed pneuma, as *ἀρχὴ θερμοῦ φυσική.* We have seen that other philosophers asked how the pneuma could be nourished before the pulsatory and respiratory functions arose—a logical puzzle like that of Achilles and the tortoise. Some were of opinion that the pneuma was, or might be, all used up in blood-making, or in fever, although in excess; Theophrastus and Straton said that in the bird the air-spirit which, if it could have permeated the body, would have become intelligence, was thus expended.[1] In such humble creatures the pneuma did not penetrate the whole body but settled in the belly whereby the food was more quickly digested; but the creature is witless.

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[1] On the Aristotelian period I am much indebted to conversations with Prof. Hy. Jackson; to Mr. Barnard Cook's *Basis of Plato's Ethics*; William Ogle's edition of the *De part. animal.*; Prof. D'Arcy Thompson's of the *De hist. an.*

But even now, when we pass on to the post-Aristotelian period, we find ourselves still pursuing the Aristotelian line of argument, and, as before, still hindered by the persisting indefinition of terms; so that from Aristotle and the earlier peripatetics down to the Pneumatists, and even to the second century A.D., the difficulty remains of tracing severally, and differentiating, psyche and pneuma; or indeed of distinguishing soul in its three kinds—vegetable, animal, and psychical. This indefinition was due of course to both immaturity of conceptions and inadequacy of language. Thus likewise, to take a familiar illustration, in the

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[1] *Καὶ τὸ πνεῦμα οὐ διϊέναι, διὰ παντός, ἀλλὰ ἱστάναι περὶ τὴν κοιλίαν· διὰ τὴν μὲν τροφὴν ταχὺ πέττειν, αὐτὸ δ' ἄφρον εἶναι* (Theoph. *De sensu*, 44).

Ethics δικαιοσύνη is used in more than one sense; then, as now, authors were not fully awake to the treacheries of words. And I repeat that too often Aristotle had used "pneuma" allusively, without precise significance. If we assume that for both Plato and Aristotle soul was in one sense a starry quintessence or ether (Zeus) (*De caelo*, i. 10), the first cause of motion, and therefore pre-existent, yet nevertheless, for Aristotle himself at any rate, "psyche" of some degree seems to have been a part of nature (p. 122); if so life had its causes, and therefore came within the field of general physics: but "innate heat" (θερμὸς ἀήρ), though secondary to psyche, the post-Aristotelians also continued to distinguish radically from ordinary heat (p. 240) (*De motu*, *De gen. an.*), and to imply that the innate heat was uncaused. Aristotle's pupil Theophrastus was content to regard innate heat as congenital; though Straton looked for a cause or mode of access (p. 254). Elsewhere, it is true, the Master had seemed to bring soul down to realising purpose (entelechy), but only as a matter of terms, not of explanation. Dr. Jackson is clear that for Aristotle the rational soul was not an entity (form? function? entelechy? creative *Nous*?). Again, although his followers relied upon certain passages of Aristotle in which the highest soul (*De an.* v. 15) seems clearly incorporeal, and to lead on to the later psychic pneuma (ἀρχή) of the Stoics—a transcendent divine spirit, or pantheism [1]—yet in others psyche and pneuma, both or either, seemed to mean no more than "vital principle"; that is, a biological cause in continuity (συνέχεια) from plant to animal, and to man; a physiological point of view.

We may conclude then that Aristotle himself drew no clear distinction between pneuma, soul, energy, and vital heat (θερμὸς ἀήρ), this last being not the ordinary heat of combustion: that πν. ἔμφυτον, ἔμφυτος θερμότης, φυσικὸν πῦρ still persisted as undiscriminated terms, and in places approximate to "form" or mould of nutrition, while the combustion side was ignored. The πν. ψυχικόν, the psychic side of pneuma, a germ in Aristotle (*e.g.* the *De motu* and *De gen. an.*), played a large part in the subsequent physiology, as of the Stoics and Galen. Reason the Stoics attributed to the fiery element or vital breath by which all things were shaped, and to which all things were to return.

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[1] "Θεός ἐστι πνεῦμα νοερὸν καὶ πυρῶδες οὐκ ἔχον μορφήν," Posidonius; an idea descended from the hylozoism of the Heracliteans.

This universal and all-penetrating soul was composed of fiery matter of which individual souls were the sparks (ἀποσπάσματα) of the πνεῦμα νοερὸν καὶ πυρῶδες.[1]

> And the souls mounting up to God
> Went by her like thin flames.
>
> *Blessed Damosel.*

The Stoics accepted the heart, whence pneuma was distributed, as the seat of the soul; the opinion of some in Hippocratic times (see Περὶ σαρκῶν, Litt. viii. 591). Thus the heart, for Aristotle only the vital governor, for the Stoics became the universal Principle—the ἡγεμονικόν. So Aristotle was as far from the Stoics as on the other hand he was from the Empirics. For instance, Aristotle's treatise Περὶ ψυχῆς is more physiological than psychological, and the title cannot be accurately translated as "On the Soul," in the transcendent sense of this word. Yet, in some passages, both Plato and Aristotle do make the soul the first cause of motion, and, therefore, pre-existent. In the *De generatione* (ii. 3. 11) Aristotle says that souls differ in degrees of honour. The inference seems to be that psyche was incorporeal, extraphysical, but could be manifested and known in combination with substance—such as innate heat, or pneuma? The idea of Reason, as a psychic faculty, had a different origin, and was developed somewhat later.

For the estimation of the sources and currents of the scientific tradition, and of the various and somewhat revolutionary doctrines which were brought into Rome during the last two centuries B.C. and the first two centuries A.D., we possess a certain very significant record, to which I have already referred, a MS. known as the *Menonian Aristotle* or *Anon. London.*[2] In the *Classical Review* of 1892 (vol. vi.) Sir Frederic Kenyon described a long but very imperfect papyrus which contains part of an Introduction to Medicine, or "Isagoge." By its style and script it appears to form part of a compilation of the end of the first, or beginning of the second century A.D.; that is, about the date of Trajan or Domitian, and to belong to the "Eclectic and hyperlogical school of Archigenes" (p. 285). In the main it is probably copied, with paraphrases, from the Ἀρέσκοντα τοῖς ἰατροῖς (*Placita medica*) of Alexander Philalethes, a physician and gynaecologist who lived about the time of our era. As Galen is not mentioned by the compiler, and as this Alexander is the last in date of his citations, the conclusion from style and opinion as to the period of the composition is confirmed. In both these respects it differs altogether from the Hippocratic Corpus.

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[1] See Conington's *Virgil*, vol. ii. 520 (note 728).

[2] *Anon. Lond. ex Aristotelis Iatricis Menoniis et aliis medicis eclogae.* Ed. H. Diels, *Suppl. Arist.* iii. i., 1893.

The first portion of the work is historical; it commences with the fifth century B.C., and deals with the schools of Croton, Cos, Cnidus, and elsewhere. The compiler begins with Euryphon the Cnidian (p. 303), and then passes on to Menecrates, in Philip's time; out of whose *Medicine* a large excerpt is made. Hippocrates he interprets after the comments of Aristotle. Thence he proceeds to deal in a critical spirit with the schools of Alexandria, of which I have already spoken. Here, with the fourth century, this record ends.

We have seen that after Ptolemy Physkon had banished the men of learning from Alexandria, a Herophilean school was established, about 50 B.C., at Laodicea;[1] to this school, in its second period, it was that Alexander Philalethes belonged. Thus the compiler was in doctrine Herophilean, and strongly anti-Erasistratean, and such was the colour under which he, and Alexander his source, represented their own times. But whence came his historical chapter? We have also seen that Hippocrates, and the same is true concerning some other ancient physicians, was appreciated under the interpretation of Aristotle, who was much indebted to Hippocrates.[2] Now it is known that the master apportioned the encyclopedic materials of his prodigious mass of notes and library[3] to several disciples—Eudemus was editor in chief; Theophrastus the editor of the materials on minerals, physics, and the physiology of special sciences; Aristoxenus on music; while to Menon was entrusted the compilation of a historical section. Menon's summary would end somewhere in the fourth century. The probability then is, that the historical portion of the anonymous papyrus of London was drawn from Menon's Aristotelian Summary, but (Wellmann thinks) under the influence of Diocles. The direct interest of this historical section, which represents early doctrines in a comparatively primitive state, it is not within my limits to discuss; but, as significant of opinion and authority in the Roman Empire, its indirect interest is, as we shall see, considerable.

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[1] This later Herophilean school survived to the end of the first century A.D.

[2] Then as now, there was much dispute as to which books of the Hippocratean Canon were genuine and which spurious. The attributions of the Menonian compiler are very dubious, not as regards the Περὶ φυσῶν only but also the Περὶ φυσιος παιδίου and the Περὶ νούσων.

[3] This library is supposed to have become the foundation of the Alexandrian (p. 70)

Now in this anonymous Menonian MS. of London it would seem that Aristotle attributed a certain book of the heterogeneous Hippocratic collection—namely, the Περὶ φυσῶν [1]—to Hippocrates himself; and it is evident that if we could fasten any one of these books upon Hippocrates we should have therein a clue to his personality, and to the authenticity of other books of the canon. Hitherto, as I have said before, we have assumed that certain works, marked by breadth of view, scientific temper, and sagacity, seemed by these very qualities to proclaim themselves as from the hand of the great master himself.[2] And perhaps this is not altogether to reason in a circle, for such qualities, by the witness of his contemporaries, were his. But, unhappily, these are not the qualities which mark the treatise Περὶ φυσῶν, a title difficult to translate into English, but which may be rendered *Concerning Airs*. Far indeed from breadth, precision, and wisdom, the Περὶ φυσῶν is a popular oration, as windy in its rhetoric as in its subject matter. In its affectations we recognise the Gorgianic rhetoric, the rules of phrase, trope, antithesis, and cadence which, with a finer art, were observed by Greek rhetoricians; as, for example, in that masterly treatise of the fifth century, the Περὶ τέχνης of the same collection.[3] It is however, like that better product of Cnidian sophists the Περὶ φύσιος ἀνθρώπου (*De nat. hominis*), a sophisticated essay of the Sicilian tradition afterwards adopted by Pneumatists in Rome. Much of it, as also of the Περὶ ἱερῆς νούσου (On the Sacred Disease), is drawn from Diogenes of Apollonia (*c.* 430) (p. 109) who, on a patchwork of air-spirits, mind-stuff, and atomism, may be regarded as a remote parent of pneumatism as a medical sect. He and his doctrines were mocked by Aristophanes in the *Clouds.* If Aristotle really did attribute the Περὶ φυσῶν to Hippocrates—well, says Ilberg, so much the worse for the medicine taught to him in Stagira! We perceive indeed how even in the fourth century the spirit and traditional values of the Hippocratic Canon were stiffening and wasting into dogmas; a lapse which, during 150 to 200 years in an uncritical age, is not surprising. Thus it was that Menon, the first of medical historians, fell into error. Himself a pneumatist, he followed Praxagoras and Chrysippus who, in the Aristotelian period, had attributed a great part of bodily function to the pneuma[1] and carried it to Alexandria (p. 138). However I occupy you with the banalities of the Περὶ φυσῶν tract only, as I might allude also to some sentences in the Περὶ τέχνης, to indicate the prevalence through the later Hippocratic tradition of the doctrines which took form as the school or sect of the Pneumatists; a school formally established in Rome by the interesting physician Athenaeus, of whom I shall speak presently.

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[1] See A. Nelson, Περὶ φυσῶν, text and studies, Upsala, 1909, and review of it by myself in *Class. Rev.*, 1910. Personally I am disposed to attribute the Περὶ φυσῶν to some follower of Diocles.

[2] The doctrine of the four humours has been tried as a test for Hippocratic authenticity, but it lands us in anomalies: *e.g.* the Περὶ παθῶν, Περὶ νούσων, and Περὶ τῶν ἐντὸς παθῶν supposed to be by the same author, do not by this test coincide; and so on. That the Περὶ ἀέρων contains little humoral doctrine is perhaps, from the nature of its subject, not surprising. Unhappily Galen's tract (probably a short one) on the authenticity of the several treatises of the Canon is lost. Mewaldt has endeavoured to extract Galen's opinions from the scattered allusions in his extant works. However this is outside our subject.

[3] *Vide* Theodor Gomperz, *Die Apologie d. Heilkunst*, 2nd edition, 1910, an able and learned but overwrought plea.

As then the Aristotelian tradition which, in this respect of innate heat *versus* combustion, prevailed, befogged and misled the thought of the Middle Ages in physiology, so in psychology hypothesis carried mind only so far as to create a capacity for receiving the higher, supernatural, implanted soul;[2] and it was in respect only of this lower capacity to receive mind, or soul, that psychology was an aspect of physiology, and even of physics. Thus Straton taught that pneuma was the organ, or carrier, of psychical functions regarded in themselves as a transcendent essence (οὐσία) which, being independent of creation, had its own determinations and its own fate. This was the essence, which in the idea of Aristotle, and afterwards of Harvey, was identical with, and a part of, the ether of the stars.[1] In Bacon's words—"the whole heaven consists of (this) fine and rare substance." To us it is peculiarly interesting thus to trace the fifth element, or "quintessence,"—added, that is, to the four elements of the old physiologists—from Aristotle to Harvey, who also conceived it as the universal principle of motion animating all things from the starry sphere of the heavens to the tireless orbit of the heart (p. 318). Now by "innate heat" Harvey did not mean fire, but either pneuma or something of the same or more abstract nature, identical with the celestial essence or primordial element, but in development linked up as cause (*αἴτιον*), with the blood-vessels as co-operative (*συναίτιον*). By this conception the idea of combustion, of motion as engendered in molecular activity, of oxygenation as we should say, was lost. When therefore Harvey attributed the marvellous periods of the cardiac function to this fifth element or "quintessence," I find he was not, as I have formerly supposed,[2] following Aristotle precisely;[3] he was attributing animal motion directly to the celestial essence; not by the mediation of a carrier, whether pneuma or innate heat. Still, once more, these great prophets were by no means consistent in the use of terms.[4]

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[1] See pseudo-Aristotle, *De spiritu* 481 a 28.

[2] How the nature of Aristotle's transcendent soul became the battleground of the medieval commentators, especially of Averroes and St. Thomas, is well known to many, at least, of my hearers.

As after this incidental anticipation we proceed from Aristotle to Alexandrian and Roman times, we shall find that a certain further development, or reconciliation, seems then to have been initiated chiefly by that Chrysippus, a younger contemporary of Aristotle, of whom we have spoken (p. 138) as one of the parents of the school; he may be taken also as the philosophical founder of explicit pneumatism as long afterwards interpreted, or I shall say reiterated, for medicine in Rome by Athenaeus. Although the obscure treatise Περὶ πνεύματος probably is not authentic as a work of Aristotle himself yet no inconsiderable portion of the doctrine, as we may note by the terminology, is Aristotelian.[1] An unauthentic treatise may of course be quite valuable evidence for its own time. We have seen that Galen[2] spoke of this Chrysippus as the father of the sect of Pneumatists (πρόπαππος τῆς αἱρέσεως) though he attributed no small share of their doctrine also to the direct influence of Aristotle. From him was taken the idea of ὕλη (Gal. iv. 612), as "matter" in the "material" sense. We have seen also that this Chrysippus, probably the master of both Herophilus and Erasistratus—of Erasistratus, if not directly yet at any rate indirectly through Metrodorus, the son-in-law of Aristotle—united in himself Sicilian, Cnidian,[3] and Peripatetic doctrines, so that by his teaching pneuma became more rounded up and established physically, not only in the heart and arteries but (for him) also in the brain. Thus from early Alexandria we trace the influence of Chrysippus on the growth of Pneumatism in the sectarian sense. Diels, in his essay on the physical system of Straton, suggests, or rather states, that the Pneumatic doctrine descended to Medicine more directly through this peripatetic teacher,[4] or through Metrodorus

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[1] In their several orbits or spheres (circular because the most perfect form) whirled the sun, moon, and planets, while the outermost sphere of the fixed stars whirled round the others with an enormous velocity animated by the quintessence or ethereal fire (Aristotle). This universe, a plenum, spun in the infinite void. The expansive elements (fire, air), being centrifugal, and the heavier elements (water, earth), centripetal, the whole was balanced; though it is interesting to note that ultimately all things (even fire itself) tended towards the centre of the earth (gravitation).

[2] C. Allbutt, *Harveian Oration* (Camb. Univ. Press, 1901).

[3] As the late W. Curtis said (in his admirable book on *Harvey's Views on the Circulation*, which appeared after these Lectures were delivered): "The entities recognised by Harvey are not only fewer than those of Aristotle, but are differently disposed within the draperies of Aristotelian language" (p. 135).

[4] As an instance of Aristotle's use of soul, pneuma, and heat (*θερμόν*) without precise distinction, see *ἔμφυτον πνεῦμα* and *φυσικὸν πῦρ* in same sense in *Parva nat.* 475 a 8, and 474 b 12. See p. 240 and Farquharson 703 a. (Let me here make a general acknowledgement of my debt to Mr. Farquharson.) Plato's view was more ethical than physiological (see *Timaeus* 90).

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[1] On this part of the subject, I am indebted to an essay by Neustadt: "Ps.-Aristoteles, Περὶ πνεύματος," *Hermes*, 1909. W. Ogle declared this treatise to be spurious, as in "flagrant contradiction to the genuine treatises and in using words in different senses."

[2] Ed. Kühn, iv. 160, viii. 631, and five or six other passages quoted by Neustadt. Also see Wellmann, *Pn. Sch.*

[3] In his earlier paper in *Hermes* (1900) Wellmann exposes a certain "chronologische Ungeheuerlichkeit," due to the confusion of the Alexandrian teacher with namesakes; and to his guidance I am here again indebted. I see here that Wellmann regards Chrysippus as directly the teacher also of Erasistratus.

[4] I cannot dwell here on the points of difference: such as that for the Peripatetics heat and cold were drastic, and dryness and moisture passive; that Athenaeus regarded these substances variably, sometimes as matter, sometimes as forces; that substances or elements, as ποσότητες, were often confounded by the Stoics with their active qualities (ποιότητες); *e.g.* water with moisture, earth with dryness, and so on. Indeed, the Stoic hair-splittings amidst these permanent or interchangeable logical counters, as between ποσότης and ποιότης, for example, are to us intolerable, and were in respect even of their own time as vain as for his time the logomachies of Duns Scotus. On the other hand the Stoics raised some of these principles to a lofty height; the all-pervading and rational pneuma becoming a part of their pantheism (the πνεῦμα νοερὸν καὶ πυρῶδες, οὐκ ἔχον μορφήν; the πῦρ τεχνικόν, etc.). They supposed that the pneuma entered the foetus with the breath (γίνεται ζῶον). In Galen's words (quoted Neustadt, *loc. cit.*): "Περιττὸν παρεισάγει κατὰ τοὺς Στωϊκοὺς τὸ διῆκον διὰ πάντων πνεῦμα." See also Jaeger's article in *Hermes* to which I have already referred.

(p. 135 *n.*) to Erasistratus of Alexandria, and thence to Rome. It is indeed in the pseudo-Aristotelian Περὶ πνεύματος[1] that we first find the pneuma definitely accepted as a fifth elemental quality. In it the doctrine is becoming less transcendent; the breath is said to be akin to the psyche (*τῇ ψυχῇ συμφυές*), and we note the advance of the association of the pneuma with the arteries; for the aorta is there regarded as a large air tube, the motive principle being within, probably in the soul (*ψυχῆς δύναμις*). According to this writer the pneuma was uniformly distributed throughout the body, and maintained the nutrition of the several parts, even of the bones; though no air ducts were visible in them. To the pneuma were attributed three functions: (1) respiration (*i.e.* refrigeration, to which the Aristotelian school clung stoutly); (2) pulsation; (3) assimilation of nutriment—pepsis plus innate heat, whereby the food was refined and the coarser parts separated: as taught by Empedocles and Diocles. By ramification of vessels on the walls of the bowels fluid was taken up through pores, "such as those in earthern filters"; this vaporises (*anathumiasis*) into ichor, and reaches the heart, wherein a second concoction makes blood (*Hist. an.* iii.). Then mingled with air in lung it is distributed, and each organ selects what it specifically needs (cf. Galen ii. *δυνάμεων*), the purest to the higher parts, the coarser (*ὑπολείμματα*) to the lower. In some of these passages also pneuma is spoken of as an intermediate agent between body and psyche.

To come now to the Pneumatists proper—to Athenaeus and Aretaeus (Archigenes ?): the sect identified the pneuma with the innate heat (*ἔμφυτον θερμόν*) as a transcendent entity, as did Zeno of Citium three centuries before Christ; and, with Aristotle, they accepted the heart (*τὸ ἡγεμονικόν*) as its seat; this tradition, as the *calidum innatum*, was accepted even down to the seventeenth century and later. As for Erasistratus so for the Pneumatists, pneuma was not the beginning (*ἀρχή*), but cooperative (*συνεργός*); and vital heat (*θερμὸς ἀήρ*) was not the ordinary heat of combustion: though no doubt innate pneuma (*σύμφυτον πνεῦμα*) was still an essence in nice balance between transcendental fiery and airy elements. At any rate it was still generally agreed, even by those who did not identify pneuma and innate heat, that this heat, into which pneuma, if not identical, could at least enter, was the demiurgic, or creative power ;[1] but that the innate pneuma (σύμφυτον) by its movement kindled this inward heat (θερμὸν ἔμφυτον), which by its penetration fused the whole into an integration or uniform harmony (ἕξις), promoted growth and propagation (φύσις) by way of which thinking came—" for vapour cannot think "—and awakened thought (ψυχή). This heat so enkindled was constantly moderated by respiration. Thus the Pneumatists as a sect followed the Sicilians and Diocles, on the Empedoclean tradition through Aristotle, and likewise regarded the heart as the seat of this inner or governing (ἡγεμών) fire, or essence, or even soul ; an attribution which was substantially that handed down thence to medieval Europe. We know that St. Paul spoke of soul and spirit (pneuma) severally. Moreover the Pneumatists, again after Aristotle, seem to have regarded soul as incorporeal unless wedded to substance,[2] a radical departure from the Ionian monistic conception. The vegetative soul however they still regarded as exclusively corporeal, and precontained in the female element ; the sensitive or animal soul being in the male, as a somatic function (engendered in his vital heat and seated in the heart as innate heat). For Paul τὸ ψυχικόν seems to have signified an animal soul. As the Pneumatists took the seat of the governing essence to be in the heart, for them it held the system of contrary forces in balance. Every sensation was a disturbance of this equilibrium ; so far a fruitful idea. Thus primary movements in the animal body were referred, in their central origin, to the heart, the organ of the soul and even of sense, whence ran psychical channels to the brain; and, for pneuma, to the lung; the soul being the highest motor,[1] and in its origin (or inconsistently as pneuma) being identical with the quintessence. For us moderns of course the apprehension of motion does suggest a previous phase of heat, a heat of oxidation; a process of which the earlier Ionians had some rational foresight, a foresight which in the Aristotelian cooling of an innate (uncaused) heat was lost. William Ogle was too loyal an advocate in suggesting (*L. and D.* p. 48) that Aristotle's doctrine of refrigeration was compatible with the doctrine of combustion—that for him respiration and combustion "were nearly allied processes." This was a mere "accommodation," innate heat needed no combustion. Galen got nearer to the truth.

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[1] Ed. Jäger (Teubner, 1913). I would suggest moreover that, although peripatetic, it cannot be attributed to Theophrastus; in some opinions it seems inferior to this author. It is a collection of problems rather than a treatise, wrestling with air, pneuma, animation of finest particles of air with soul, and so forth.

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[1] The element was not primarily active, it was but quantity (ποσότης) ; it was on its quickening into a quality (ποιότης) that it became creative. And it is to the *qualities*, says Wilamowitz, that the platonic term τὰ στοιχεῖα is properly applicable. The pneuma provided, as it were, the λόγος of this conversion. And, as if this were not ingenious enough, the pneuma was itself regarded as consisting in three phases, ἕξις the grossest, φύσις the generative, and ψυχή the finest—sensation and thought. And above these was the ἡγεμονικόν, or ruling reason, placed by Aristotle, Chrysippus, and Athenaeus in the heart. If, as we have seen, by some, as by Empedocles, Theophrastus and certain pneumatists, this will, or mastery, was placed in the brain ; how, said the rest, could this ardent function energise in the coolest part of the body ? I may remark again however, as a curious inconsistency, that the respiration of fishes by means of the air dissolved in the water was known to the ancients ; not only to Diogenes of Apollonia, Anaxagoras, and Theophrastus, but long before their time—probably to the Sicilians (pp. 111 and 237). Still Aristotle, in the *De respiratione*, ignores the air in the water and refuses to regard the branchial function as breathing, on grounds which seem to me rather logical than scientific ; *e.g.* the innate heat of the non-breathing animals, as they are colder by nature and milieu, did not need so much ventilation.

[2] See *Gen. an.* ii. 3. 736 and 6. 29.

Before Alexandria then, and long before the formal and sectarian doctrine of pneumatism in Rome, an earlier and informal pneumatism was conceived of which Celsus either had little knowledge, or regarded as outside his subject; as indeed it was. We perceive that Pneumatism, which on the Peripatetic side contemplated the vital principle in three modes, was a much larger idea than mere animism. However, as we passed on from these vaporous essences as elaborated in Plato and Aristotle, we saw that the dynamic view of life was carried forward to Alexandria rather through Diocles and the Sicilian school, by which Plato was especially influenced, than through the Hippocratean tradition, which was petrifying into maxims or "dogmatics." This was unfortunate, for the Italo-Sicilian Philistion, Diocles—who housed the implanted pneuma in the left ventricle—and the author of the Περὶ καρδίης, carried forward to Alexandria, and so to Rome, the notion of respiration as a cooling process; whereas certain of the Hippocratic school regarded it, at any rate in part, as feeding the heat of the body (*e.g.* Hipp. iii. 153, Basel edn.).

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[1] In the Jowett series of translations of Aristotle Mr. Farquharson leans to the genuineness of the *Περὶ ζώων κινήσεως*; at any rate it gives, except in one difficult passage, the exact doctrine of Aristotle: see also Jäger, *Hermes*, Bd. xlviii. H. i. Ss. 29-74, where this able commentator gives a careful and minute analysis of the peripatetic doctrine on the pneuma, with the Alexandrian modifications.

Now to us as physiologists it is of peculiar interest to observe nevertheless the effort made by the later and more scientific philosophers still to carry on and uphold the dynamic essence "between air and fire," in the sphere or belt of which the mediating essence worked the intensest functions; whether of human, animal, vegetable, or inorganic creatures. Thus, if we may restrict our attention to the life of the warm-blooded animals, I would emphasise the point once more that these early thinkers had the prophetic insight to perceive that by means of air, and particularly of some rarefied fiery quality or phase of the common air, life was carried on by a process of the nature of combustion; but that unfortunately this fruitful conception was checked, in respect of animal respiration, by that contrary doctrine of Aristotle of which I have spoken; and was not recovered until the middle of the seventeenth century, by Thomas Willis. It is on this larger view of the history of pneuma that we note most clearly the beginning and pursuit of the pathetic quest for oxygen which, from Empedocles to Willis, Lower, and Mayow, and from them to Priestley and Lavoisier, drove philosophers, physicists, chemists, animists, and vitalists like a gadfly.

We have found the history of the ideas of Animal Heat, and of the place and functions of the Psyche, to be so intricate, various, and confused, that, at the cost of reiterations, it may be convenient to sum up severally the ancient phases of each before pursuing the ideas of respiration, innate heat, and combustion through later centuries. The interminable but vital controversy between the theory of Animal Heat by internal combustion and the doctrine of Innate Heat is one of the most remarkable and most cardinal conflicts of ideas in the history of medicine, so cardinal that we may pass out of our limits to glance also at its issue. Broadly speaking, the former hypothesis prevailed as I have described it from Ionian times to Aristotle; the latter held the field from Aristotle to Alexandrian times, when the combustion hypothesis, although still opposed by the peripatetics, recovered some ground, and at least held its own till the time of Galen, whose attitude in the controversy was equivocal. I have spoken of the Ionian idea of a surrounding air or ether armed with its fiery quality, its quickest and subtlest particles. This demiurgic fire was manifest to them not in animal life only, but also as the vital spirit of all creation—the *respiratio mundi*, of macrocosm and microcosm—the primitive forecast of oxygen. Let us take the psychological summary first.

SUMMARY OF THE IDEAS OF THE SOULS.—To disentangle the intricate historical relations of the psychical attributes to the brain, and those of air, heat, and metabolism ("coction") —the somatic attributes—to the brain, and to the heart and circulation respectively is no easy task. The still and bloodless brain ("bloodless and cold," Arist. *Hist. an.* 495 a) appeared to the ancients rather as a chilling than a quickening body. Even yet to us, to the modern psychologist, this subtle organ, the hidden miracle of the body, is less enkindling than the warm and lively heart. Even we have not yet the ultramicroscopic engine which may reveal to sight the spinning of its myriad shuttles and webs, the shimmering of its swift and intricate functions. All this we have to suppose; we do not see it; it does not look like it: we are not surprised then that, even for Aristotle, the brain was continually losing its character as a fountain and ruler of energy. We may wonder indeed how, in the conceptions of certain Hippocrateans, of certain of the school of Croton, and of others of the pre-Aristotelian period before the nerves were discerned, the brain held its own as the seat of the understanding. It held its own chiefly because the special senses, especially the chief senses of sight and hearing, had their seats about it, and by certain "ducts" obviously led into it (Alcmaeon). Even in the Italo-Ionian pedigree, from Pythagoras to Diocles and Plato [1] (*Tim.* 84), the idea of a necessary synthesis of the sensory data—the *Sensus Communis* (p. 105)—won some way; the brain, or that finest air in it, was its apparent seat, and pneuma the means of fusion. Pythagoras, who seated the passions (*θυμὸν*) in the heart—a distinction which has endured almost perennially until this day—was yet the first Greek, known by name to us, to place the soul (*i.e.* mind and wits, *τὸ λογικόν*, *φρόνησις*) in the brain.[2] His younger contemporary of Croton,

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[1] "Is the blood the element with which we think, or the air, or the fire; or . . . the brain may be the originating power of the perceptions of hearing and sight and smell; and memory and opinion may come from them?" (*Phaedo*, xlv. 96 B, Tr. B. J. vol. i. 475).

[2] *Θυμὸν δὲ ἐν τῇ καρδίᾳ ὑπάρχειν, φρένας δὲ καὶ νοῦν ἐν τῷ ἐνκεφάλῳ*; but some of the older Hippocrateans also, especially of the Coan School, were of this opinion.

Alcmaeon, dividing thought from sensation, held the same opinion;[1] and Anaxagoras, when he demonstrated the lateral ventricles of the brain, believed that he had discovered the very seat of the soul or mind, an allocation which prevailed down to Posidonius in the fourth century A.D.[2] Not only so, but it was seriously reproduced, by Sömmering, at the end of the eighteenth century (*Ueber das Organ der Seele*, Königsberg, 1796).

Empedocles and the Sicilian school in this respect departed from the Pythagorean and Coan schools; and we remember that, like the Jews and Harvey, they looked upon the blood rather than the heart as the seat and carrier of the soul (or life); partly because therein the four elements seemed to them to be most uniformly blended. The heart they regarded nevertheless as the most important organ in the body;[3] and herein Diocles followed them. We know that some of the physicians of the fourth century however, indeed Diocles himself, regarded the heart as the governing or co-ordinating centre of the body and the seat of the soul, or reason which Diocles was the first to identify, or to confuse, with the pneuma; and we know that for Empedocles the blood was primary, pneuma derivative: but, as we have seen, Philistion, the contemporary of Plato, and from him Philolaus and Diocles, took the converse view, and, regarded the heart as the maker of the psychic pneuma from the air or ether (words rather indifferently used), yet, holding an intermediate position, supposed that this spirit was delivered thence to the brain as the ministry of the special senses, while the central and implanted heat remained in the heart. But was the air, or breath, the generation of the soul; or, as Praxagoras said, only its invigoration (ῥῶσίς τις)? These, and such crossings of doctrines were caused by the common attribution of the passions to the heart, even by those who placed the intellectual functions in the brain; for the popular distinctions between these faculties of the human mind were then no more categorical than they are to-day. If now we turn to the Hippocratic tradition, we shall find that, speaking generally, the Coans, with Alcmaeon and Pythagoras, attributed the mental faculties to the brain; the Cnidians, following the Sicilians and Diocles, to the blood. Thus the Coan author of the *Περὶ ἱερῆς νούσου*, a work probably older than Diocles, says (c. 16) *κατὰ ταῦτα νομίζω τὸν ἐγκέφαλον δύναμιν πλείστην ἔχειν ἐν τῷ ἀνθρώπῳ, οὗτος γὰρ ἡμῖν ἐστι τῶν ἀπὸ τοῦ ἠέρος γενομένων ἑρμενεύς, ἢν ὑγιαίνων τυγχάνῃ· τὴν δὲ φρόνησιν ὁ ἀὴρ παρέχεται* ("For these reasons I look upon the brain as holding the mastery in man, for so long as it is whole, it is the interpreter of the influences of the air; for by the air comes intelligence"). And Soranus says of Hippocrates: *ὁ δὲ Ἱπποκράτης τὸν μὲν νοῦν φησιν ἐν τῷ ἐγκεφάλῳ τετάχθαι, καθάπερ τι ἱερὸν ἄγαλμα ἐν ἀκροπόλει τοῦ σώματος*[1] ("Hippocrates says that mind is set in the brain, as it were a holy image in the acropolis of the body").

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[1] *Ἁπάσας δὲ τὰς αἰσθήσεις συνηρτῆσθαί πως πρὸς τὸν ἐγκέφαλον*—somehow all the sense perceptions were compacted together in the brain. See Theophr. *De sens.* This passage is the only one I can find which bears on this subject, and, as regards cerebral function and Sensus Communis, I think it will hardly carry all the meaning which has been laid upon it. See however Aetius iv. 17. Still it fully recognises co-operation of the senses in the brain, so that Alcmaeon for a while gave to the brain the lead which Aristotle gave to the heart. For Alcmaeon and the three souls, see p. 99.

[2] See art. by Walter Sudhoff, *Arch. f. Gesch. d. Med.* Bd. vii.

[3] Κεφαλὰ *μὲν νόω, καρδία δὲ ψυχᾶς καὶ αἰσθάσιος . . . ἐγκέφαλος δὲ τὰν ἀνθρώπω ἀρχάν, καρδία δὲ τὰν ζώω.*

This Hippocratic and Crotoniate tradition, placing mind in the brain and honouring it as the "acropolis of the body,"—later, the *viscus excelsis simum* of Pliny—must have influenced the great Alexandrian anatomists Herophilus and Erasistratus; in spite of Praxagoras. Both schools were agreed however that pneuma (air) carried the vital principle.

But Aristotle, as is well known, had made the heart, which Lamb called "that little three-cornered exponent of all our hopes and fears," the centre of all the mental faculties except the supernatural soul which was independent of matter, and indeed capable of its full activity only in the degree of its emancipation from matter; and he denied that touch and common sensation and taste were of the brain. He divided mind into three faculties: perception (*φαντασία*), memory, and recollection, and placed them all in the heart: phantasia pertained to all animals and even to those without understanding; *διανοία* or *νοῦς πρακτικός*, to the higher animals and man. He accepted the three under-souls—vegetative, animal, and psychical—and seemed to regard them, although of the whole and in every part, as entities.[2] As to the emotions and sensations, we are well aware, he said, of the heart's control over these. His successor Theophrastus, however, gave the hegemony of the body to the brain, and brought back the psyche thither.

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[1] Fuchs, *Anec.*, quoted Wellmann, *Fr. Sic.* p. 19.

[2] It is difficult or impossible to say when this idea of the tripartite soul arose; then it was held by some and not by others.

About the same period the author of the Περὶ καρδίης held the Aristotelian opinion, including in the heart's attributes γνώμη, which we may here translate as absolute intelligence—something more than the φρόνησις (pneuma or air) of Diocles and Praxagoras—which reigned over all other spiritual functions; an opinion which led on to the full Stoical acceptation of the hegemony of the heart.[1] Galen (*De plac.*) taught that the generation of the animal spirit near the cerebral ventricles was by the choroid plexus (p. 297); thence it passed to the spinal cord and nerves (sensation and volition), and also to the arteries and veins. In Marvell's words,

> A soul hung up as 't were in chains
> Of nerves and arteries and veins.

This soul was sustained by pulmonary and cutaneous respiration. He wondered whether the pneuma actually passed through the body, or acted by force without matter, "as the sun does."[2]

But when and how did the embryo get its psyche? When did the zoon become a besouled and perceiving being (οὐσία ἔμψυχος αἰσθητική)? If the psyche be nourished or carried by the pneuma, when does either begin? For Galen the first moment of animation was the *punctum saliens*, but for others, as we have seen for Straton, it was the moment of insemination (p. 228)[3]; and so on.

Herophilus described all the ventricles of the brain,[4] seated the soul in them, and re-established for a while the doctrine of cerebral ascendancy. Of the nerves Aristotle knew little or nothing, the nerves of the special senses he had regarded as ducts; but the Alexandrian anatomists demonstrated their origin in the brain (p. 150), and supposed them to be bundles of fibrils or channels serving as carriers or messengers of the psychical functions (Galen ii. 95-99 K.). When Erasistratus canalised the pneuma in the arteries and left cardiac ventricle (*thalamus pneumaticus*) he detached it from the psychical functions, identifying it rather with, or as the source of, the "animal soul." Athenaeus and Archigenes also and many but not all of the pneumatists transferred the soul, as we should expect, from the brain to the heart and arteries; being herein the followers of Chrysippus, Praxagoras, and Erasistratus (Galen, *De meth. med.* xii. viii. 19 K.). Some authors however still claimed the soul (*πν. ψυχικόν*) for the brain. In this chapter of history we may rely more surely upon Galen as, from the Alexandrian time until his own, there had been no new doctrine on the subject. Galen himself did but adopt and fortify the opinions of Hippocrates, Alcmaeon, and Herophilus on the place of the brain as the organ of mind; *i.e.* of perception, thought, and memory.[1] The soul flowed thence as from a well, either by the nerves or, as above, "immaterially as the sun acts on us." It was mainly on Galen's authority that this view prevailed with the later Stoics, and, during the decay of physiology, until the revival of learning when the teaching of Aristotle came again to the surface. And the attribution of the passions to the heart still lingers in our common tongue, not without excuse; for when the central circulation fails, instantly our psychical faculties vanish with it. Herophilus had explained sudden death as heart failure (C. Aurel. *M. Chr.* ii. 1). Indeed, in all the periods we have been discussing, some part in the housing of the passions (*θυμός*), and of certain qualities of the "soul," seem to have been conceded to the heart. With remarkable unanimity I think all the Greek animists, from Alcmaeon to Aristotle and onwards, explained sleep as a retirement of the blood from the brain into the larger vessels; and waking as its re-diffusion (Aet. v. 24. 1). Thus again, we cannot tie down all these prophets and their words to our own preciser categories. It is said that Plotinus was the first philosopher to recognise "consciousness" as such.

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[1] The fanciful attribution of spiritual functions, or at any rate of the passions, to the Homeric midriff (whence the medical term "phrenitis") need not detain us. This spirit however, if we must take Galen's interpretation, was not the soul in the highest sense; it was its organ, the "spiritus animalis, which arose from the brain as if from a well" (*De meth. med.* xii.).

[2] See Farquharson's note on Ar. Περὶ ζώων κιν. 703 a.

[3] See C. Allbutt, *Class. Rev.*, June 1915.

[4] See Galen, *De usu part.* vii. 11. The third ventricle is said to have been described by Aristotle, but in the *Hist. an.* (495 a) he speaks of but one cavity.

As regards *disorders of the psyche* to which there are many allusions in the Hippocratic books, much confusion arose from this attribution of mind and emotion to the heart, thence to the praecordia, and therewith to the diaphragm, or phrēn, an error rebuked by Hippocrates. Thus came our word frenzy, and that of phrenitis to mean delirious states; these Aretaeus attributed to the brain. He also recognised mania and melancholia as phases of one series of events[1]—"the same disease." He dwelt on the influences of the abdominal organs on sanity, and was the first to use the term "melancholia" in the modern sense, but attributed it to the black bile (spleen). Puerperal mania is mentioned more than once in Hippocrates, Asclepiades, Celsus (Alexandria), Soranus, Aretaeus, all of whom realised the bodily causes of insanity; although as a pneumatist or eclectic, Aretaeus put soul or pneuma in the heart. The writer of *Epid.* ii. 5 describes symptoms of stuttering with the tongue and loss of control over the lips (χειλῶν μὴ ἐγκρατέες ἐόντες), that signified among other possibilities, insanity (μανίη). This characteristically Greek way of looking at the causes of insanity led to an enlightened and humane system of treatment which was lost again to the world until Pinel and Conolly! Some mechanical restraint was used, but the main therapeutical lines were fresh air, graduated exercises, persuasion, diet, baths, and other regimen (pp. 186 and 209).

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[1] Φανταστικὸν καὶ νοητικὸν καὶ μνημονευτικόν. See Galen, *De sympt. diff.* a. iii.

PHYSIOLOGICAL SUMMARY.—The school of Hippocrates, chiefly Ionian, was informed in the main by this spirit. Empedocles and Hippocrates, in the fifth century, thought already that the vessels contained with the blood something derived from the outer air (Anaximenes) that they called pneuma, and that fed the heat of the body.[2] The later Hippocrateans however began to vacillate, and to talk of heat as an entity innate in the heart, and thence distributed about the body; if in excess it caused fever. Meanwhile Diocles, who was critical and eclectic, had proposed another side of the problem, which he had derived from Empedocles; he looked for one source of animal heat in the fermentation (coction) and decomposition of digestion, beginning with the air and moisture in the stomach and propagating itself all through all the processes of nutrition; the heat and chyle going to the blood, the refuse to the gut. The pneuma then, diffused through the system, was separated at the periphery into the animal and psychical kinds.

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[1] See the description in Euripides of the *Hercules furens*; and Giles, *Proc. Camb. Philolog. Soc.* 1906.

[2] As, amid much that is fanciful, in the treatise *On Regimen.*

To digest, in a wide sense of the word, was thus the physical begetting of the internal heat, dyspepsia being due to crudities (unconcocted); no very unsound opinion, so far as it went. Diogenes of Apollonia (*c.* 430 B.C.) taught that even perception, pleasure, and thought arose by the mixture of air with the blood by the respiration.[1] Some such peptic, coctive, or maturing power was attributed to the heart by Aristotle also, and by many after him.

In this respect the prodigious genius of Aristotle was unfortunately on the wrong side. Unrivalled as an observer, Aristotle had not Darwin's powerful scientific imagination. Although, like Plato, he drew much of his physiology from the Hippocratic schools, he took from the Italo-Sicilians the notion of the heart (or blood) as the seat of the soul and understanding, and their view of the respiration (*ἀναπνοή*); that is, although it drew the pneuma through the body from the lung (*διαπνοή*), beginning thence its *ἔργον*—its peculiar faculty, yet the main or only function of the lungs was, as a bellows, to cool the entity heat, innate in the body. And the brain was regarded by some (Aristotle) as taking a small part in the cooling.

Precisely when or how this unlucky perversion, of the function of air in the breathing body into the opposite cooling process, first arose, is not clear. We find it in Philistion and Diocles (Galen iv. 471 K.) who lived a little earlier—in the first half of the fourth century—and in the fourth-century Cnidian and Italo-Sicilian treatise Περὶ καρδίης. However it was from Empedocles and Diocles that Aristotle took this idea, with that of the hegemony of the heart. From Wellmann's *Sicilian Fragments* it would seem that, for Aristotle as for Plato, the carrier of the theory of innate heat and of the lung cooling function, was Philistion, the pupil of Empedocles. Be this as it may, the terms "pnoē," "pneuma," "psyche," etc., as handed on from Philistion by Philolaus to Athens, while often fanciful were always equivocal. The Empedocleans, and Harvey, exalted the blood above the pneuma or heart; though Philistion regarded the pneuma as the spirit of the world and of life and health, and delivered this doctrine to Plato and Diocles and, by Eudoxus and Chrysippus (390–337), to Alexandria (see Ritter and Preller, S. 113).

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[1] See Theophrastus, *De sens.,* where Theophrastus makes the reactionary objection that some animals have no respiratory organs, some no blood.

Pythagoras thought that the innate heat of nutrition was contained in the female germ; the animal or sensitive soul in the seed of the male; the rational soul being immaterial. He prophesied that plants must have some vital heat. The main historical note of the verbose and dialectical but also in detail brilliant treatise *De respiratione* is the preservation of the idea of the cooling process (σωτηρία τῆς καταψύξεως) in those higher animals which are not cooled by living in moist or airy places, an opinion which, such was the ascendancy of Aristotle, prevailed even with Galen and onwards; so that the respiration was regarded as tempering the heat innate either in the heart, air-cooled (like a motor engine) (Aristotle), or in the blood (Empedocles, Harvey). Aristotle assumed innate heat in cold-blooded animals by the analogy of the mammalia. Neither Aristotle nor Harvey realised the call of the tissues for air; whence Harvey's wonder why the blood should have to run round the body so many times a minute; nor did it occur to any of the ancients, so far as I remember, that the expired air, save for its load of "fuliginous" matter, might be different from that inspired. Of the great Alexandrian schools, Herophilus and Erasistratus (*c.* 300 B.C.), or at any rate Erasistratus, broke through the doctrine of the heat or pneuma as congenital (innate); and argued moreover that the arteries, and also the nerves from the brain, were channels of this mode of energy (πνεῦμα κινητικὸν καὶ αἰσθητικόν). However, as I have supposed, so far as the few fragments of their writings go, it does not appear that the Alexandrians gave much attention to the physiology of respiration; although in the tradition of Philistion it was regarded as a function, by the pores, of the whole body. For Herophilus life consisted in nourishment, warming, thinking, and feeling; for which functions the liver, the heart, the brain and nerves, respectively, were the organs; the pneuma being drawn in both by lungs and skin from the air. Of the opinions of Erasistratus on the respiration we have little record; we know little more than that he also denied the Aristotelian doctrine of the congenital (innate) heat, and taught, with his colleague, that the animal heat or pneuma was indrawn from the air, and carried from the lungs to the heart; whence the animal soul was delivered to the body and the psychical to the brain.[1] But some authors, even down to Galen, supposed that some psychic pneuma passed directly to the brain through the nostrils to the cerebral ventricles ; though this direct psychic inspiration never took a great place in ancient psychology. The intervention of spirit in the play of natural forces was dismissed by Galileo, and the theory of the conservation of energy shut it out. Psychic, moral, and aesthetic potentials were all implicit in evolution.

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[1] For E. the souls were two, not three, as also in earlier times; *e.g.* in the Hipp. *De victu.*

Let us now link on this ancient physiology to modern times.

Athenaeus (first century A.D.) and the pneumatist sect for the most part followed Aristotle in the doctrine of innate heat, the hegemony of the heart, and the cooling function of the lungs. Athenaeus also accepted the cutaneous respiration, but more as a way of expelling " fuliginous " matters than of receiving pneuma. He did not accept animal heat as uncaused, as did the " innate " schools ; by accommodation with the views of Diocles, he supposed that much of the heat was generated in the liver, and carried thence to the heart for distribution. He taught that some blood ran in the arteries as well as in the veins, but that in the arteries there was more pneuma, in the veins more blood ; quite a laudable doctrine.

We have seen that the opinion of Galen (A.D. 130–200), in respect of respiration was somewhat ambiguous. Huxley, in an *obiter dictum* which had some vogue, credited Galen with greater insight into the problem of the animal heat than properly belonged to him.[1] His words were as follows : " Part of the blood, it was supposed, went through what we now call the pulmonary arteries, and branching out there, gave exit to certain fuliginous products, and at the same time took in from the air a something which Galen calls the pneuma. He does not know anything about what we call oxygen ; but it is astonishing how very easy it would be to turn his language into the equivalent of modern chemical theory. The old philosopher had so just a suspicion of the real state of affairs that you could make use of his language in many cases if you substituted the word oxygen, which we nowadays use, for the word pneuma." This is true ; it is a phase in what I had called the pathetic search for oxygen ; but we have seen that this divination did not pertain to Galen, but rather that he muddled what he had received of it from his forerunners. Huxley's appreciation of the Greek physiologists was valid, and it was not his purpose to search farther backwards in time. And it is fair to add that throughout his treatise on the use of respiration Galen discerns that what is needed of the air is not its volume but some quality in it (*ποιότης*); and he often harks back to the need of breath for animal heat; yet this was to be by way of the innate heat somehow (*e.g. χρείαν εἶναι τῆς ἀναπνοῆς ἐμφύτου θερμασίας*.

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[1] Huxley, Harvey Lecture, Nov. 2, 1878, p. 441 of his *Lect. and Essays.*

Galen then, unfortunately holding both the doctrines of innate heat—which with mind he seated in the heart (*e.g. De anat.* l. 7), and of respiratory cooling of it, doing justice to neither thesis, and supposing moreover that the pneuma was nourished partly by distillations from the bodily juices (*ἀναθυμίασις*), passed on this confused and unfruitful tradition through the wilderness of the Middle Ages down to the time, let us say, of Leonardo, when the first signs of a reawakening of the spirit of science heralded the approach of the dawn.

Galen had said that the heart received a crasser, the lungs a more vaporous blood, and that the pneuma of the lungs reddened it. Leonardo also distinguished between scarlet and dark blood, and observed more definitely that the air made the change.[1] Caesalpinus (sixteenth century) taught that a *spiritus* was mingled with the blood in the arteries, and that it *moved* the blood. Harvey, as I have just said, relied on the innate heat and, regarding the lungs as cooling fans, was puzzled why, if the blood were but a feeder of the tissues, it should run round the body so many times in the minute. At the close of the eighteenth century the chemical play between the blood and the tissues, the heat of functional activity, was imperfectly, or not at all recognised. Even Lavoisier supposed that all the aeration took place in the lungs.[2] It was Willis who made the return to biochemistry, and he first, and soon after his pupil Lower, produced the change of colour in the blood experimentally—admitting and excluding the air. In the second and fourth chapters of his Second Book (*Opera omnia*, Venet., 1708) Willis says that the animal spirit is not only a substance in space but by nature a certain kind of fire or flame, or a vapour, breath, or essence of flame (*halitus*, or *substantia, flammae*); or something akin to this. He then refers, as we have done, to many ancient philosophers as of this opinion; among the moderns he names Gassendi and Fernelius. Willis concludes that the spirit in the blood is concerned in some kind of combustion (*accensio*), though not visible as shining or sparkling. A little farther on he says that wherever there is animal life there is fire of a nitrous and sulphurous nature, even in insects and fishes (see 196 *n.*), and other cold-blooded creatures; and this is quenched at once if air be withdrawn.[1] He perceived that these combustive changes took place in the blood throughout the body and not in the lungs only. On turning to Fernelius I find that, for the most part, he reproduced the Galenic confusion of respiration as cooling and as combustion. He did say however that without air for respiration an animal is soon suffocated; not for lack of cooling but of its proper heat and spirit (*non quod a refrigeratione sed quod ab idoneo caloris et spiritus alimento destitutum sit*) . . . because indeed of suppression of the fumes of the innate heat (*insiti caloris spiritusque*). He did not recognise air in water for aquatic animals as some of the Greek fathers had done (pp. 111 and 248), but regarded the moisture as the means of cooling their innate heat; still from the moisture (*ab humore*) they drew "some warm and spirituous nourishment."[2] A generation later Fabricius held the same doctrine (see i. 4), and Sir Thomas Browne (*V. and C. Errors*, ii.) says by air "the contemporation of that fervor in the heart, and the ventilation of that fire always maintained in the forge of life," etc. Others (Helvetius, Descartes) supposed the air to serve for condensation of the blood. However about this time (Descartes, Haller), the classic distinction of heat into two kinds —innate and general—which has given us so much trouble, fell into doubt. It was now argued that all heat, such as the heat of friction, of fermentation, etc., was of the same nature. Willis showed that respired air became unfit to support life on a flame, not because of an effluvium (Galen's *fuligo*), but of the abstraction of some necessary element. We have seen that even in Ionian times the question had been raised whether it were the whole air or some finer quality of it ("something between air and fire") which wrought this change; and this vital problem was further explicated by John Mayow of All Souls who found in saltpetre also a *spiritus nitro-aërius*, or *particulae igneo-aëriae*, necessary for respiration and fermentation. This fiery spirit, he said, consisted in a swift movement of contiguous particles, or subtle atoms, dependent upon the supply of something sulphurous or nitrous derived from the ambient air. Mayow writes, "Breathing brings the air into contact *with the blood* to which it gives up its nitro-aerian constituent, and from which it carries off the vapours produced by the heating of the blood." Again "the motion (of the muscles) results from the chemical reaction *in the muscle* with the combustible matter contained therein." Thus Mayow in 1668, as Boyle in 1670, proved the need of oxygen for both land and water animals; though this gas was not isolated till in 1771 Priestley brought the millennial pilgrimage to a Pisgah view of oxygen. Yet Lavoisier's results were ignored by physiologists almost until Ludwig's thermo-electric researches.

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[1] See Klebs' able studies on Leonardo: *Boston Med. and Surg. J.*, July 6 and 13, 1916; and *Bull. Soc. Med.*, Chicago, Jan. 1916.

[2] It is remarkable that although he verified the heat of oxidation, he attributed the generation of it to the lungs only.

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[1] "Declaravimus quibus initiis flamma vitalis incipit, per quos gradus accrescit, et post ἀκμήν diminuitur—quare haec non, uti flamma vulgaris, visibilis et destructiva fuerit sed animae corporeae tanquam formae superiori subordinatur" (ii. 4).

[2] "Hoc igitur modo qui inspiratione haustus est frigidus aër, celerrime ad interna quaeque penetrat, iisque refrigerationis commoda subministrat."

Mayow still thought, with Diocles, that the heat of the blood was derived in great part from digestion. Boyle demonstrated the *pabulum ignis*, "volatile nitre or some anonymous substance" akin to the maintenance of flame, by experiment on small animals with his air-pump, and noted the rise of water in the receiver as the animal breathed; or as a candle burned. So at length, in a crude way, Mayow and Boyle had succeeded in recognising oxygen; though its isolation was yet to be deferred for another century. The last masquerade of heat as an entity was in the notion of what Withering called "that monster phlogiston." Professor Soddy says, "The phlogistonists had a single eye for what we now call energy; Lavoisier for what we now call mass."[1] They saw the thermodynamic view so clearly and compactly that they had no room for the molecular and atomic hypotheses. Withering left the monster to be dealt with by Priestley, on whose discovery Withering wrote an essay *The Death and Burial of Phlogiston*.

Of this kind then, so far as these limits have permitted me to unfold it, was the doctrine of the pneuma, a metaphysical idea foreshadowing vital combustion. And pneuma, whether under this name, or, in refluent waves of aboriginal ideas, under such names as the vegetable and animal souls, as the Archaeus, as van Helmont's vital principles, as the animal spirits of Descartes, as the motor nervous fluid of Stensen, as the animism which in the early eighteenth century sprang from Chemistry, as the vitalism again which sprang from the doctrine of irritability, or as the transcendent vital quality beyond physico-chemical virtues entertained by some leading physiologists to-day—*πολλῶν ὀνομάτων μορφὴ μία*—must, in so far as it is an imported entity, make a free pathology and an inductive therapeutics almost impossible. Vitalism is the phlogiston of biology. And meanwhile the humoral pathology had to be counted with, even by the pneumatists. If the pneuma might become hot and dry as in fever, cold and moist as in dropsy, too dense or too light with many consequences; or again, too quick or too sluggish: if it might be pent up, as in epilepsy and constipation, or, as in hysteria, imprisoned in the womb, so again the humours also might be crossed, or crossing, in one or more of the many possible permutations of dyscrasia. The Hippocratean doctrine was that health and disease depended upon the crases of qualities. That health consisted in a eucrasia was, as we have seen, an axiom of that spectral sage Alcmaeon of Croton (p. 100); and the conception of diseases as modes of the many possible dyscrasias which survived down to Galen, by him was regenerated, and so flourished in a crude form through the Middle Ages; indeed in a sublimated form it still plays no small part in pathology. These humoral doctrines the pneumatists did not abolish; they made these intricacies still more complicated, coiling them into a mesh which at this day it is hard to unravel. The story is nevertheless curious, as the study of an intense mental hunger, with but a scanty harvest of knowledge, feeding upon itself. And not only in the first and second centuries A.D. in medicine, in Neoplatonism, and in the Christian Fathers, but again in the thirteenth century, and in the ingenious speculations of the sixteenth and seventeenth centuries against which Sydenham led his masterly revolt, we see history thus, in principle, repeating herself. It was well therefore that the empirical reaction initiated in the earlier Alexandria by Philinus the Coan and later by Serapion (p. 166), narrow and ungenial as it seemed, and, more fruitfully and scientifically, the admirable surgery of the age, curbed the extravagance of the pneumatic and other metaphysical opinions; and this protest it was which made the Pneumatist Sect strictly so called, although backed by the Stoics, but a transient phase.[1] Indeed, its own greater men, almost from the first, began to hedge by a prudent eclecticism. And it is true that their central doctrine of the pneuma was less prejudicial to surgical progress, which they forwarded upon Alexandrian anatomy, than were their unbridled expatiations, a wasted or even a mischievous energy, in the field of inner medicine. Still that the Pneumatist emphasised the dynamic side of physiology is true; and that, like the Methodist, he recalled attention to the solids of the body; yet, by personifying the pneuma as an indwelling and creative entity, he provoked a reduction of the functions of growth, work, and excretion to a passive machinery worked by a demiurgical finger; thus the whole framework of digestion, for example, became for him a mere gizzard, a mill for mechanical contrition of food; and therapeutics a magical checkmate. For even the Methodist, or at any rate the Lucretian atomist before the formalist Themison, while animated no less by the dynamic idea, had regarded energy more truly as one aspect of a quick matter than as the demonic master and manipulator of a material engine. And the sceptics of the day, on narrower if surer ground, were teaching, almost with the decision of Locke, that thought can be built only upon the functions of the senses. Even for Diogenes of Apollonia [2] phenomena, the pneuma having condensed into them, were but phenomena, not outside realities: and concepts therefore were fashioned wholly of the products of our senses. The defect of these critical schools, at any rate of the Empirics who did not realise that we see what our minds are trained to see, was, as I have explained, an intolerance even of the chaster Hippocratean reasoning on causes, and a repudiation of anatomy which reminds us of Sydenham's unhappy aversion from pathology.

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[1] *Nature*, Aug. 10, 1916.

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[1] I venture to repeat that Gomperz, like Susemihl, has generously insisted that, whatsoever the inconsistencies within the faculty itself, this service for a more positive method and influence was one for which ancient philosophers were indebted above all to Medicine.

[2] Cf. Krause, *loc. cit.*

CHAPTER XI

SOME PNEUMATIST AND ECLECTIC PHYSICIANS

After this somewhat tedious history of the idea of the pneuma, I may illustrate its application to Medicine by some story of the chief medical teachers of the pneumatic school, so far as we know them. However far-reaching, even perennial, was the pneumatic doctrine, I repeat that Pneumatism, as a medical sect, was of brief duration ; and for the most part its adherents are no more than names to us. Not only so, but from its very beginning as a sect Pneumatism was modified by the Eclecticism which penetrated it more and more. Besides, a large element of Methodism survived in this and other schools down to the Middle Ages. I shall speak more fully of two physicians—of Athenaeus, the formal founder of this school in Rome, and Archigenes who, if an Eclectic, came forth from the Pneumatist School.

Athenaeus of Attalia was one of the most interesting of the Romano-Greek physicians. Diels, in his essay on the physical system of Straton, emphasises the doxographical importance of Athenaeus, who adopted and formed his opinions with much critical judgement.[1] As to his date, Athenaeus who, like most of the Roman physicians, emigrated to Rome from one of the colleges of the wealthy Hellenic cities of Asia Minor, was unknown to Celsus, who lived in the days of Tiberius and to whom Methodism was known ; but to Galen, who cites him frequently and in terms of much respect as an author and *savant*, his works were well known. We may assume then, if perhaps he was born under Tiberius, that he flourished in the reign of Claudius. Athenaeus seems to have perceived how Methodism, in the sense of an atomic physiology, was already withering ; that in practice it had dried up into two or three abstract maxims or common rules (κοινότητες), such as the strictum and laxum, whilst its Epicurean philosophy was in Rome giving way to Stoicism. The Dogmatists were stereotyped and uncritical, the Sceptics barren. The Stoics themselves were then needing a philosophic groundwork. Thus intelligent men felt something more was wanted, and Pneumatism, coming as it did in the tradition of the elder medicine—Sicilian, as we have seen, as well as Coan, Cnidian, and Alexandrian—and in alliance with the ascendant stoicism, offered to fill the want. Athenaeus therefore had a large school, or following, in Rome. His doctrine he formulated thus:[1] The pneuma (διῆκον διὰ πάντων) is the world soul, the living self-conscious god, from whom the souls of men, animals, and plants emanate; it is also the maker and fashioner of all matter. The four elements (qualities) he accepted, but it was the all-penetrating pneuma, which passed from the lungs to the heart and by the arteries to the whole body, that by its tides determined health and disease. For Athenaeus then animal soul and pneuma were almost identical, as a whole, or integrating principle, to its parts; there was a vivifying principle in the arterial blood, and furthermore pneumatism was still a philosophy as well as a physiology. But pneumatism, as we have seen, represented a physiological principle of a kind so attractive that, under the phases of many schools, it survived in its essence until the eighteenth century.

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[1] See also Wilamowitz, *Gr. Lesebuch*, Berlin, 1902.

Athenaeus wrote a large and important work, Περὶ βοηθημάτων, which probably dealt with all departments of medicine. Unfortunately this work has almost wholly perished; for what we know of Athenaeus we are dependent upon fragments surviving in Oribasius, and upon allusions by other authors. These relics suffice however to indicate that Athenaeus was a clear and accurate observer, apt in reflection and criticism, and wise in philosophy. To these gifts he added a large and various learning spiced with a shrewd irony. Pneumatism does not seem to offer much in the way of rules for practice, but its leaders were successful doctors, especially as surgeons. For instance, Athenaeus—like later Pneumatists, or Eclectic Pneumatists,

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[1] In what follows I am indebted especially to Daremberg's *Oribasius and Rufus*; Wellmann's article on "Philumenos," *Hermes*, 1908, and on "Ancient Medical History," *Hermes*, 1900, and continually, of course, to his *Essay on the Pneumatists*; also to Neustadt's article in *Hermes* (xliv. i. s. 60-69). And I do not forget my general debt to the several essays of Diels.

Herodotus, Archigenes, Leonides, Heliodorus (see Juv. 369-372) —was a good surgeon. He operated for cancer of the breast and womb, and was clever in controlling haemorrhage. Herodotus, said to have been a pupil of Agathinus, was a physician of distinction in Rome; he is said to have differentiated measles. Moreover the school was not clinical only. Besides its considerable therapeutical content, it taught also (as in the *Περὶ βοηθημάτων*) an elaborate physiology and pathology which, within my present limits, I may be able to illustrate by a few examples, especially by its teaching on the pulse.

Athenaeus, who did much to weld together philosophy and practical medicine, apportioned the sphere or faculty of medicine into five divisions. The first was physiology, which for him was the essential foundation; herein he made a great advance upon the Methodists and the Empirics. While accepting with the four elements the animating pneuma (*πν. σύμφυτον*) in its three degrees—the main corporeal energy, the energy of growth and reproduction, and the finest psychic energy—he accepted hot, cold, moist, and dry as units, or entities (*ἁπλᾶ*). He placed the fundamental qualities (*ποιότητες*) *before* the elements themselves (earth, fire, water, air), and in their mixtures he conceived to lie the origins of bone, flesh, sinews, etc. Thus for the pneumatists the four "rational qualities" are sometimes bodies, simple or compound (*ποιότης, ἦ ὥς ἄμεικτον, ἦ ὥς μεμειγμένον σῶμα*), sometimes powers (*δυνάμεις*); a scheme of physiology which Galen contested, but not on grounds very interesting to us.

Of his next or second division, that of pathology, but little is known directly; yet we incur little error in interpreting the pathology of the master by that of his greater successor Archigenes. Both arteries and veins contained blood, and pneuma, but the arteries more pneuma; unfortunately the distinction between empty arterioles, nerves, and sinews, pointed out long before by Erasistratus and others, was not always remembered. The liver from the food made the blood, and the blood the humours (Hipp. and Timaeus). But a main feature of his pathology, that upon which I would dwell for a moment, was the study of the causes of disease; for herein the school returned to the sounder tradition of Hippocrates, avoiding on the one hand the facile and jejune etiology of the Methodists, and on the other the narrow concentration of the Empirics upon superficial and immediate antecedents. His eminent disciple Agathinus of Lacedaemon, the teacher of Archigenes, who lived under the Flavian Caesars, became definitely an Eclectic, combining empirical and methodist doctrines with pneumatism. He made some experiments with herbs on dogs. Thus they returned to the Hippocratic study of causes; and, as soon modified by Eclecticism, contributed largely to the Stoic philosophy, on which the teleological argument also was engrafted; and Urkraft became identified with Urstoff.

Of the logical classification of these causes we read in Galen enough and to spare; and we of to-day, in our array of causes, are still somewhat addicted to outworn categories, such as the *predisposing*, the *exciting*, and so on. In Rome, from the time of Asclepiades, the sects which did not ignore the wider causes, with moderation divided them into three classes at least, according to their nearness or remoteness in the series of antecedents. Thus Athenaeus did not expatiate in a wilderness of logical but unnatural categories. The Pneumatists conveniently distinguished αἰτία from διάθεσις, by which they signified all which pertains to the conditions of the disease in the individual. Disease (νόσος) was the dyscrasia; πάθος was used variably, as the lesion or as the functional disarray; fever, for instance, as abstracted from symptoms of fever.[1] Erasistratus, like Galen and Morgagni in later times, had laid stress not only on the kind of malady (ὁποῖον πάθος) but also on the part affected (τὸν πάσχοντα τόπον) (p. 153). Συμπτώματα were the consequences of the dyscrasia. The dyscrasia, a perversion of health (eucrasia)—the ancients perceived in these rhetorical antitheses substantial as well as verbal values—was for the genuine pneumatist an atony or taint of the pneuma, to be counteracted by marshalling against it the contrary quality—as cold against fever, and so on; so that, as we shall see, physical means of cure prevailed with this school, such as diet, clothing adapted to the several seasons, exercises, waters, and so on. The fusion of their vitalistic pathology with the humoral, which for clearness' sake we are disregarding in this lecture,[2] was in its completion the task of Galen. By him the soul, or vital dynamic, in its three kinds—the vegetal, the animal, and the psychical soul—and the qualities of the elements were harmonised, so far as logic could harmonise them; for instance, phlegm was akin to moisture, yellow bile to fire, black bile (spleen) to earth, and so on; the qualities being mixed in the blood. But it would be futile to enter further into these logical permutations; I have said enough to give a notion of their method.

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[1] Herophilus pointed out that certain πάθη might be natural (κατὰ φύσιν), such as childbirth or the secretion of milk; others unnatural (παρὰ φυσιν), such as fever. Still πάθος was often used in equivalence with νόσος, especially perhaps by the Methodists (*e.g.* ἡ παθητικὴ στέγνωσις, etc.).

[2] We find the humoral pathology as far back as Herodotus the historian, who tells how (iv. 187) the Libyan shepherds used to burn the veins on the vertex or temples of

It is interesting to perceive how in certain other ways also Athenaeus and the Pneumatists went back to Hippocrates. I have touched upon their observation of climates and waters; Athenaeus laid great stress upon pure filtered water. The third pneumatist division was Dietetics; then came Materia Medica; and fifthly and lastly Therapeutics, a title with a larger content than is usual with us, and almost signifying clinical practice. His description of the uterus was the two-horned—male on the right, female on the left—and the ovaries (like the male mammae) were rudimentary representatives of the testicles.

The vast commerce of the Ptolemies, and in some measure no doubt the lore of Pharaonic Egypt, had flooded the markets of Alexandria with quantities of new drugs. One writes to a friend to send him good quality of drugs "lest he do otherwise and send him stale stuff which will not pass muster in Alexandria,"[1] etc., and the keen inquiry for them was far more than the legitimate demand of the medical practitioner. One may say approximately that with the treatise of Theophrastus Περὶ τῶν δακετῶν καὶ βλητικῶν, began that prodigious and diabolical literature on the art and mystery of poisons and antidotes in which, not always without the aid of medical accomplices, kings and nobles of the empire and its principalities, and after them popes and cardinals of the Church, were the experts (pp. 349-351). We remember the bent of the Herophileans, onward to Galen and the Galenists (through Andreas, Krateuas, Apollonius Mys, Zopyrus), was to polypharmacy. In the decadence of Alexandrian science and society this gross propensity increased and multiplied; and under the influence of perfidious potentates, such as Mithridates, Nicomedes, and Attalus, attained to an infamy almost grotesque.

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their children to prevent fluxions of rheum (καταρρέον φλέγμα). Sepsis of the juices (χυμῶν) was a very old dogmatist view of Fever. Adams, in his edition of Paulus, says that an able and full account of the humoral pathology is to be found in Macrobius (Saturn vii. 4).

[1] Milligan, *Sel. Greek Papyri*, 1910, p. 58.

Under the foul accumulations of panaceas, mithridatics, and cosmetics, elaborated with a perverse and loathsome ingenuity, medicine was oppressed and almost suffocated ; and the habit of heaping up ingredients made its way into the compounding of legitimate prescriptions. Thus to build up a huge and conglomerate bolus or potion became the ambition of the doctor, and the faith and consolation of the patient. If your liver is getting impatient, writes Juvenal in the XIIIth Satire, " seek Archigenes as fast as you can, and buy of him the composition of Mithridates, and you will live to eat figs and gather roses another year." [1] But to this subject I shall devote a special chapter (Chap. XVII.).

It seems clear then that the undoubted influence of Chrysippus in the Alexandrian schools points to him as the moulder of the theory of sectarian Pneumatism ; and from Egypt came the bent to polypharmacy. The testimony of Galen, as cited by Neustadt and others, is not inconsistent, as we have seen, with a no less considerable direct debt to the Peripatetics ; for Athenaeus drew freely upon Aristotle. Another most interesting link of the tradition we have noted in Diogenes of Apollonia [2] (p. 109)—namely, that both Aristotle and Theophrastus avoided any radical distinction between pneuma—as the original or even as the one primary element, in which thinking stuff was implicit, and out of which accordingly came order in the universe—and common air ; though they soon entered into refinements, notably as concerning that vague but penetrating apprehension of oxygen —the " substance between air and fire "—on which I have dwelt. More fancifully, airs might be drier or damper, hotter or colder, more attenuated (spirit) or condensing into phenomena ; and so on. Thus Diogenes seems to have been superior to the rhetorical sophistry of which the pseudo-Hippocratic treatise Περὶ φυσῶν (p. 243), and others like it, consist ; of a settling down of lofty and prophetic ideas into coarser notions of blasts and tensions of air compressing, expanding, shaping, or disintegrating an inert matter. So by ruder and less apprehensive minds two great dynamic ideas—the pneumatic and the atomic hypotheses—were debased ; while the sagacious and prudent clinics of Hippocrates were frittered away in frothy rhetoric, formal and arid Dogmatics, or barren Methodism. In the absence of sufficient tests of premises and of sources this lapse into sterility was perhaps inevitable; and the Roman temper was always in favour of such thumb-rule formulas as Themison and the Empirics provided.

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[1] We observe here that Archigenes sold the drugs himself.

[2] Recently well edited, with Introductory Essay, by Krause, Posen, 1908–9. This Diogenes is to be distinguished, of course, from the (later) Stoic. Vid. et Diels, *Fragmenta* in Ed. of *Excerpta Menonia*, Berlin, 1893. And Axon Nelson, Περὶ φυσῶν, Upsala, 1909, p. 101.

This sect also lasted longer than is generally supposed. We find the title "Physician and Pneumatic" in inscriptions down to the fourth and fifth centuries. It is true notwithstanding, as we shall see for instance in Aretaeus (Archigenes), in Heliodorus, and in Galen, that beneath all the sophistry and metaphysical physiology, a substantial medical and surgical wit was making its way, fortified in the main by the stream of that Alexandrian science which, in its turn, had its sources in Aristotle, in Magna Graecia, and in Ionia.

The Pneumatist school passed into the Eclectic almost insensibly. Of the *Eclectics*, so far as they formed a coherent or independent sect, I have not much to say. To the academic student, it may seem perverse that, with so many features in common, the various sects of which we have spoken kept so bitterly aloof, each within its own conventional palisade; but in our own day, with far less excuse, are not these tribal animosities still as fierce, almost as stubborn, as they were in certain Pneumatists who, according to Galen, put their sect before their country? Many of them, poor things, had no country; and the Pneumatists, in the breadth of their ruling idea, seem to have been more disposed than men of other sects to sympathise with alien opinion. Thus it was that many of the Pneumatist school approached, and indeed joined hands with, the Eclectics; but in no period of culture has a consciously eclectic school found the secret of life, nor made any important place for itself in the history of ideas. Eclectic systems arise from no organic growth of reason; they are mosaics artificially compacted, and have proved therefore to be but temporary accommodations, and seminally impotent. Happily men are often better than their systems. The pneumatic doctrines had been indeed modified, or masked, generation after generation from Alexandrian times onwards, by empirical, sceptical, stoical, and eclectic tendencies, and even by changes of denomination, before they were at length formulated for Medicine in Rome by Athenaeus.

Of *Agathus*, and after him of *Agathinus*, who were important links in the chain between Athenaeus and Archigenes, we really know very little; but it would appear that both of these physicians played a considerable part in the fusion of doctrines to which I have referred; a fusion which made the sect rather than the essential doctrine of the pneumatist short-lived. Greenhill regarded Agathinus as having taken the lead in these eclectic or "episynthetic" modifications: *ἐκλεξάμενος τὰ ἀρέσαντα ἐξ ἑκάστης τῶν αἱρέσεων.* An "Eclectic" as Wellman says (*Pn. Sch.* p. 11), was a pneumatist who tried to get in Methodism and Empiricism also, as did Agathinus, Archigenes, and Herodotus; but the attempt to blend pneumatist, methodist and empiricist doctrines was eminently the work of Archigenes. This great physician, who was a pupil of Agathinus, said of his master that he was accurate in all things, and ripe in experience. Still guided by three main clews of pneumatist doctrine—namely, the pulse lore, the fever lore, and the hygienic, paedagogic, and dietetic forms of therapeutics—we perceive at this period more explicitly the fusion of Pneumatism, Methodism, and Empiricism, with a younger and more liberal Hippocratic, or clinical, medicine. It has often struck me as a remarkable instance of the independence of individual genius that although Democritus and Hippocrates were contemporaries, and presumably in some association, yet the clinical strength of Hippocrates was not inflated by cosmological extravagances. In the Pneumatist succession we may note also the continuous use of Methodist technical words—such, for example, as *ἔνστασις*, a stoppage of the pores; whereas in Rufus, an independent Hippocratean, we find none of these sectarian catchwords (p. 288). This blend of old and new suggests to us progress, an orderly development of medicine; and we shall see presently that a solid, sagacious clinical school—variegated, indeed, by some sectional dissent—survived, and superseded the arrogant domination and sterile maxims of Methodists such as Thessalus. And yet on the Dogmatic or clinical side such evidence of sound development was accompanied not merely with a respectful appreciation of older doctrine but was also cumbered with a mechanical tradition of form and letter that seems to us lacking in the spontaneity of life.

It is chiefly in respect of Archigenes that I must tarry for a few words upon what we call *plagiarism.* Our eyes are being opened to its prevalence in times past in measures which to us are astonishing. We were wont to suppose that the medicine of summists, of copyists, of large and literal transcripts, belonged to Byzantinism, and signified then the routine, if not of decrepitude at least of a torpid conservatism; yet we have seen that the dead hand of the scribes must be recognised much farther back than we had supposed, to a period not only far before Oribasius and Aetius, but before Varro. Far above the ranks of the copyists and bookmakers this practice extended unrebuked; even men of natural genius, such as Soranus and Galen, plundered largely, literally, and anonymously; so did that imposing surgical phantom, Antyllus; and so, says Wellmann, did that no less considerable surgeon, Heliodorus, whom, on the slender relics that remain, I am disposed to regard as of still richer genius. Quintilian does not formally disapprove those wholesale borrowings of Persius from Horace which enrage modern scholars. In discussing then all these romano-hellenist medical writings, we must bear in mind the custom among them of lifting both terms and volumes of the literature one from another, and this without acknowledgement; unless when, happily for us—as often in Galen—controversial animosity goaded to personal attacks. Even Aristotle mentions his sources rarely, if ever, when he borrows; often when he rejects.[1] Tacitus (*Ann.* xiii. 20) makes a remark which sheds some light on the custom of ancient writers in this matter. He says: "nos consensum auctorum secuturi, si qui diversa prodiderint sub nominibus ipsorum trademus" ("I follow my authorities without mentioning them by name if they agree"). On *secuturi* H. F. notes "inasmuch as we intend to follow"; *i.e.* "the course which he has taken and still means to take." Nearer our own times Sir Thomas Browne (*V. and C. E.*, ed. 1686, pp. 16-17) says: "Not a few transcriptively, subscribing their names to other men's endeavours, and meerly transcribing almost all they have written; the Arabs transcribing the Greeks, the Greeks and Latines each other . . . transcriptive relators to be embraced with caution." Then, after a long list of instances he says: "Plagiary had not its Nativity with Printing . . . I wish men were not still content to plume themselves with others Feathers. . . . Thus may we perceive the Ancients were but men, even like ourselves."

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[1] See W. Ogle, ed. *De part. an.* xvi., and instances given.

That Celsus named his sources so generously may in the enemy's mouth be one more point of evidence that he was a layman! Pliny, who probably helped himself freely from Dioscorides (p. 375), makes no allusion to him.[1] And Dioscorides himself, in making no mention of Crateuas, set Pliny no better example. Diodorus however, like Oribasius, in his large collection of historical materials, often mentions his authorities (see Smith's *Dict.* in loc.). Still, to find another compiler frank enough to indicate the sources of his materials, we have to travel down as far as Vincent of Beauvais,[2] who however was largely indebted to William of Conches. We must remember that in ancient times the greater writers of each epoch formulated a body of more or less consistent doctrine, often in an aphorismal and even rhythmical style, and in the only language then available, which perhaps imposed itself upon their successors rather than yielded itself to them as spoils. Indeed therefore it is often hard to say in letters what is property and what is theft. Of a certain chapter Wiedermann [3] says, " Theodorus may have copied from Marcellus rather than from Pliny ; and as to passages common to Pliny, Theodorus, Marcellus, and the pseudo-Apuleius, it is difficult to decide which copied from the other ! " Copyright, or copy-courtesy, is then a very modern notion. Before the invention of printing, when men relied upon verbal memory, whole sections of standard works, many of them, composed in verse for memory's sake, would abide in men's minds as a sort of common property, and be known as such. Halifax said of the religious tracts of Charles I., " He might write it all himself and yet not a word of it his own." And, long after the invention of printing, the contents of books were still regarded as common property, even by publishers of the standing of Wechel and Plantin. The works of Vesalius were copied and abridged time after time ; as for example the copies published by Thomas Gemini (1545), and Valverde ; and this although Valverde was himself a good and progressive anatomist. As regards substance then we cannot confidently distribute passages between several possible authors unless it be by scrutiny into such signals as allusions to current events or persons, inflections, dialectical and grammatical characters, and individual turns of words and thoughts. Indeed we are all of us so deeply indebted for our literary capital to those who have gone before us that, as we write, we are often unable to say whence came the matter that found its way into our brains and so to our pens.

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[1] Scholars seem to be agreed that Dioscorides wrote just before Pliny.

[2] Vincent of Beauvais distinguished his own contributions as of " Actor."

[3] Wiedermann, Marcellus, *De med.*, Berlin, 1916.

Again, admirable and original as are many of the best of Galen's writings, yet it is not sufficiently well known that, according to this habit of the times, a large part of the prodigious bulk of them was borrowed from other authors, and without acknowledgement. To a paragraph taken from Antyllus I have already referred; yet Antyllus is not mentioned, so that some have supposed he lived after Galen. Furthermore Rose (*Anecd. Gr.* pp. 22 *et seq.*) has pointed out that the *Comm. Hipp. d. hum.*, pp. 394-416, when compared with corresponding passages in Aristotle (*Meteor.* ii. 4-6) and with the extracts from Antyllus in Oribasius (ix. 9 and 12) (Gal. *l.c.* pp. 400. 8-401. 7; xvi. pp. 147-8 Kühn) and from Athenaeus (pp. 401. 12-402. 5), prove to have been carried over almost word for word. Indeed by this, and other such instances which he gives, Rose is led to place Galen, as a bookmaker, little above his loyal disciple Oribasius (who by the way did acknowledge his sources), Aetius, and Paul. Even in Galen's Commentaries on Hippocrates many passages ("grosse Lappen"), precisely indicated by Rose, are taken word for word from Athenaeus. How indifferently these ancient authors copied from each other may be further illustrated by a certain polemical quotation by Galen from Soranus; this is preceded by a long passage from Asclepiades, which also was taken directly from Soranus; yet no mention of Asclepiades is made. Unfortunately, as I have said, Galen, as a disputant, betrays no discipline of playing the game; he dragged phrases out of their context, coloured them, and quoted the authors in his own words, thus mixing his notions with theirs. Still from early times there was some conscience in the matter; thus Eratosthenes, the geometer, was nicknamed Andreas the "Biblioaegisthus" because he nibbled up other people's books like a goat. We may conceive the indifference of the ancients to literary piracy, or to being pirated, when we remember that until Galen wrote a certain lost treatise on the authenticity of the several works of the Corpus, no one bothered his head as to who wrote "Hippocrates." We may compare here also the uncertainty of authorship of the books of the New Testament. Authenticity was not regarded as of any importance. And when was a MS. said to be *published* ?

In the fragmentary and disconnected state of the records of the period then, and the prevalent habit of pillage, we cannot be sure whither and how many of these embedded remains are in their origin and order to be redistributed. Any such distribution which, with the aid of far greater scholars than myself, I may now attempt, will therefore partake of this uncertainty, and be in its nature provisional; yet if only in justice to the memory of Archigenes it must be attempted.

Archigenes and Aretaeus.—To appreciate Archigenes, one of the greatest of the physicians of this period, we must first discuss the place of Aretaeus, who, by name at least, is familiar to us all. And probably not a few of us, attracted by the story of the past, have perused, or at any rate dipped into, his treatise, so admirably rendered for English readers by Adams; and have been deeply impressed by his gallery of diseases—portraits select, succinct, deft in their handling, and speaking of character and experience. Galen, more diffused in generalities, never painted such telling pictures of morbid species. From it we have formed, and justly formed, a high opinion of the medicine of the age. This impression I say was just; but that Aretaeus in person justly deserved the distinction is another matter. The ancients gave him no such meed. The author, who drops systematic pneumatism in his practice, which, as I have said, returns to sound Hippocratic lines and probably was moulded in some part upon Asclepiades, and who interprets pneuma merely as *φύσις* in the Hippocratean sense of *δύναμις ζωτική*, or generative energy, yet by phrases here and there, such as his emphasis on *τόνος*, betrays his school. His date is as yet unknown;[1] the extreme suggestions are far apart; some historians (Kossmann and Lachs) put his life before our era, others, such as Wellmann, even at the end of the second century A.D. or beginning of the third; in any case his works fell into a long neglect. It is curious how rarely he is mentioned by other writers. He is not mentioned by Galen, nor Galen by him; although both authors dwelt much on the pulse, and were well furnished in anatomy. To Latin and Arabian authors he was wholly unknown.

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[1] On the date of Archigenes see Klose, *Janus*, N.F. i. 126.

The first mention we have of him is in the sixth century, by Aetius; then by Paul in the seventh; thereafter he sank once more into oblivion till the middle of the sixteenth, when the Greek MS. of a large part of his work was discovered, and was printed in Paris in 1554. Then it was observed that the treatise was written in Ionic Greek; now in his day the "Ionic sing-song" had become a literary fancy, and to use it in medicine an affectation, even—so competent scholars assure us—an affectation so "grotesque" as to strengthen some suspicions of the writer's originality in other respects.[1]

Was the neglect of Aretaeus by the ancients because they knew him to be but a second-hand and archaistic scribe? It does seem probable that in Aretaeus the Cappadocian, who so far as we know never visited Rome, we find a conspicuous example of that prevalence of servile copying and recopying without acknowledgement which, not unknown among ourselves, then prevailed in the large measures I have indicated. We shall not of course estimate these annexations by modern ethical standards. We have seen that in ancient times original matter when published was regarded contrariwise as the common property of the reading public; "*δεδημοσιωμένα του καταβέβληται.*" Delicate and complicated as is the task of tracing such stolen property from one obscure author to another, yet if out of it may come to light the figure of Archigenes of Apamea, of the time of Trajan, who, like Asclepiades, seems to have suffered unmerited eclipse, we must try, if on main lines only and by omitting some of these impressions of form which we call the higher criticism, to make clear in summary[2] concerning these records certain restorations and redistributions suggested by modern students.

Of the professed compilers Oribasius, who lived during the last three-quarters of the fourth century, was the chief; but of his seventy books only about one-third, containing a good deal of surgery, is extant. His sixth book is our bridge from Celsus. The chapters on the poison literature are lost. We know, honest man, from his own references, that he swept into his net Dioscorides, Archigenes, Antyllus, Philumenus, Philagrius, Poseidonius, and

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[1] We must not forget however that, traditionally, Ionic had become the language of science.

[2] In this summary I rely chiefly on Wellmann's *Pneumatists*, on his *Philumenos*, on his edition of the *Περὶ ἰοβάλων ζώων*, and on his article in *Hermes*, 1908, Bd. xliii.; also on Daremberg's editions of Oribasius and Rufus, and Littré's fragments of Oribasius.

Galen. More than a hundred years later flourished another such scribe, namely Aetius, who studied at Alexandria, and was indeed a person of some consideration; and in his collection lies our main source, after Pliny, of the poison literature. But Aetius, luckily, did not copy from quite the same sources, nor quite the same things, as did Oribasius; he borrowed much from Asclepiades, and, so far as extant MSS. inform us, he made a larger use than did Oribasius of Philumenus. Now who was *Philumenus*? Well, he too was an eclectic Methodist and Pneumatist of the generation of Galen (after 180 A.D.), and likewise a compiler after the spacious manner of Oribasius; but only some portions of his work, those contained in Aetius and Paul of Aegina, were known until Wellmann's discovery, in the Vatican, of 37 short chapters of his work, happily indeed in this case with the names of the authors submitted to his scissors.[1] As Philumenus again had gathered his materials from somewhat different sources, these three compilers throw cross lights upon each other and upon their various originals, so that by comparing them certain identifications begin to appear.[2] Philumenus has this particular value for us, that Archigenes seems to have been one of his principal sources. He took Archigenes as his model of arrangement of materials; his description of venomous animals, his catalogue of poisons and so on; and throughout in detail they have much in common. This inference first suggested itself to Wellmann while reading a chapter containing an antidote to viper venom, which he recognised as the antidote of Archigenes. This antidote is given also by Paul, who cites Archigenes as his source. Now Aetius, in all the diseases concerned, while similar to Aretaeus, is fuller, and presents also some peculiar differences; for instance, in respect of pleuro-pneumonia and empyema Aretaeus does not extend beyond Soranus. In respect of headaches and of epilepsy the identification can be carried further; for herein

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[1] This discovery was one of the many fruits of the formation of the preliminary catalogue for the Corpus by the associated academies. Unfortunately so far, a vast pile of MSS. thus revised and catalogued has brought in little; such matter as 150 indifferent MSS. of the Aphorisms; 100 of the Prognostics, and so on, with quantities of arabian, syrian, and hebrew translations. So it may prove that for Galen we shall have little better than the Ed. Pr., or for Paul than the Aldine. And Aetius is complete only in the Latin version of Cornarius. There was a sad waste of MSS. in the fury of early printing. (See sixth vol. of Pauly-Wissowa; art. on Dioscurides.) Also *Aelius Promotus* (p. 383).

[2] See Philumenos, ed. in *Corp. Med.* x. i. 1; parallel passages noted in Nicander. F. E. Kind (*Hermes*, 1909, p. 621) finds more still, especially of course in recipes, in many of which, where the ingredients are written in the same order, mere copying is evident.

Soranus, and even Galen, and much later Alexander of Tralles, as well as Aretaeus, followed Archigenes. Not to detain you on points of cumulative evidence, I may say that in the divisions of matter, in the way in which certain drugs are selected and used, and the like, there are further coincidences which are very significant.

The conclusion seems to be then, that Aretaeus was a copyist, as frankly was Aetius; that they copied from some source common to both, and that this source was Archigenes, whom indeed Aetius honestly names. Wellmann, comparing parallel passages, declares that Aretaeus is just a servile copy of Archigenes, if not directly, then by the intermediacy of Philumenus; if so, so much the better. But I would remind you that there is much verbal identity with other authors in Galen also, as for instance with Celsus; and if I may venture to demur to a judgement of a distinguished scholar, it would be that in many such passages the agreement is substantial rather than literal; and in a broader sense I would urge that similarity of terms, and even of phrases—"literary universalities"—do not necessarily convict an author of plagiary. Phrases which become current in one period fall out in another. In the medical journals of to-day we may readily note the professional phrases and shibboleths of our own time, especially in the writings of the less literary of our brethren. So it was under the Roman empire; although, for instance, Aetius did not copy Oribasius, yet in many places there is much similarity between them, and no little verbal identity. It is fair to add that Aetius entitles his work *Synopsis* of the works of Oribasius, Galen, Archigenes, Rufus, and other celebrated physicians. Nevertheless it seems more than probable that, whether through Philumenus or not, Archigenes was the main source of Aretaeus; and that Philumenus, who reproduced Archigenes, was in his turn the main source of Aetius, and no inconsiderable source of Oribasius. In any case Aretaeus is a second-hand writer.

However there is yet one more of these compilers to whom, if you will forgive me, I must refer—namely, one *Alexander*, of whom I at any rate know nothing more than a remarkable treatise, easy to lay hands upon as it stands first in Ideler's collection. It consists of two sections, one on problems and one on fevers; and with this it is that we are now more particularly concerned, for this fever chapter is in close conformity, often in verbal identity, with Galen's writings on fever, the pathology of which, with some qualifications of his own, he drew from pneumatist sources. Now in both Galen and in Alexander we find fever divided into two categories, thus: (1) as to severity, the great and little fevers (*πυρετοὶ μεγάλοι καὶ μικροί*); (2) as related to the three kinds of bodily substance respectively—the dense, the moist, and the vaporous (*στερεά, ὑγρά*, and *ἀερώδης οὐσία*)—that is to say, quotidian, septic, and hectic. But on turning to the same passages in Alexander we find a third category—as to "rhythm"; namely, slow, quick, intermittent, and continuous; though it is added that as the motions of heat are infinite so these rhythms glide the one into the other. And, in respect to those kinds of bodily substance, he goes on to say that the harder its constitutional substance the less is the body swayed by the fever, and the less the sympathetic propagation of its motions through the system: thus a quotidian is brief because it vibrates only in the rarest substance of the body. Now this additional matter Alexander must have got from the large work of Archigenes, mentioned by Galen, *Περὶ τῆς τῶν πυρετῶν σημειώσεως* (On the symptoms of fevers), from which he had made a somewhat larger excerpt, than had the others, from the common source to which they all betook themselves. Now fortunately Galen (viii. 203) gives the title of an important pathological work of Archigenes; and Oribasius (ii. 146) that of his work on therapeutics namely, *Τῶν ὀξέων καὶ χρονίων παθογνωμικά*, and *Θεραπεία τῶν ὀξέων καὶ χρονίων παθῶν*, respectively; both apparently in four books; and these titles, as we shall remember, correspond to the four books of Aretaeus, On the Symptoms and On Treatment of Acute Diseases, and On the Symptoms and On the Treatment of Chronic Diseases. Aretaeus, if we may judge by some details, such as that of the animal uterus, dissected only animals. He accepted the "wandering" of the uterus.

Now we have the titles of two others of the more celebrated treatises by Archigenes—namely, the *Περὶ τῶν κατὰ γένος φαρμάκων* and the *Περὶ τόπων πεπονθότων* (in three books), to which Galen gives high praise. The work on the seats of disease would have been an invaluable document for the historian. We are told that in it Archigenes, with a genuine clinical instinct, inquired if, from a comparison of the varieties of functional perturbation, or symptom groups, seats of disease could be inferred;

if there be, that is, a signal group for each seat? For example, if we observe this series—orthopnoea, rusty, or dark and livid, or frothy sputum, fever, pain in the side, and a rapid pulse—we may infer a peri-pneumony. Dyspnoea is common to many maladies, it is true, but we interpret it by its associates; as in this case by fever, the kind of sputum, and so on. Galen (*De locis affectis*) scoffs at a narrower argument of his, that the seats of disease might be discerned even by several kinds of pain; apparently it did partake too much of the nature of a sophistical exercise, for Galen complains of its new-fangled notions and terms; nevertheless the method was a sound one. Moreover upon it Archigenes seems to have built another fruitful clinical idea, that of sympathetic parts, and primary and secondary symptoms. Thus, like Head and Mackenzie, he pointed out how disease in a certain part might betray itself by pain or disorder in a distant part, not itself diseased. He instances, and very pertinently, confusion of vision caused by a disorder seated in the stomach. These views, and the seat of the hegemonic pneuma in the heart, Galen contested; though on the whole treating his great predecessor with respect, and paying him the equivocal compliment of copying from him extensively, often without acknowledgement. For example, Galen's description of that notorious disorder the πνὶξ ὑστερική—the hysterical suffocation, is identical with that of Aetius: as are both with that of Philumenus, the plagiarist or copyist of Archigenes.[1] (See Aret. Περὶ ὀξ. παθ. ii. 11.) This description was that the restless uterus attacked the heart through the arteries, the liver through the veins, and the brain through the nerves; the simulation of death was described; and the cause was attributed to a chill to the pneuma, a pathology opposed to the more rational notion, of Soranus, of an inflammation of the womb, which engendered in the cavity a cold and moist phlegm, in quantity no doubt small; but, as he urges, how minute may be the deadly venom of a snake, or of a mad dog! Now, in commenting upon this account in Aetius, Valentine Rose proved, by critical facts with which I will not trouble you, that Aetius did not copy from Galen, but, as we have seen already, from Archigenes, the common source of both writers.

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[1] We may conveniently regard Galen's works as consisting in eminent part of his own original observations and thought; in part of fugitive pieces concerned with questions of the day; in part of compilations.

On other subjects, as concerning the cynanches, for instance,[1] and certain drugs and their uses, a like correspondence with Archigenes—and the identification is of great importance—is probable, but I will touch on two more coincidences only—namely, concerning elephantiasis, and concerning the hellebores used in the treatment of it.

Elephantiasis was so hideous, so alarming, and so conspicuous a disease that, if prevalent, it could not escape observation. We may recognise this horror in its various names, such as leontiasis and satyriasis. On the evidence of silence then we may guess that elephantiasis did not appear in Italy until about the time of Themison and Celsus. The first description of the disease, so far as we know, was written in the third century B.C. by Straton; a description handed down to Themison through his master Asclepiades. Of this disease and of its treatment Aretaeus gives a full report;[2] and Wellmann, comparing it passage by passage with that of Archigenes, as preserved in Aetius, points out that in this chapter again Aretaeus was a plagiarist of Archigenes. The treatment of the disease was also identical in both—namely, venesection at the elbow, hiera, hellebore, whey, viper preparations; and likewise externally for the tubercles the unguent was similar.

The hellebores were in occasional use by physicians in more ancient times. Herophilus, on whose bent for pharmacy I have already insisted, seems, in some opposition to Erasistratus, to have pushed the use of these drugs; and under Themison, Archigenes, Rufus, and others they came into common practice; as is well known to all classical scholars. Anticyra, Sicily, and Galatia produced the best kinds. Hellebore was used chiefly perhaps for melancholia (which, as I have said, was generally, or always, regarded by the ancients as a toxic disorder), for other insanities, and for pains in the head. Aretaeus further appropriates from Archigenes full directions for the use of these herbs; the white hellebore to act especially upon the upper bowel, the black on the lower; and, if a prompter action were required, the herbs were to be cut very fine. They were used also as urgent emetics. In spite of the prudence of Asclepiades in therapeutics—a prudence and reserve I dwelt upon last year—and the large development of the physical methods of treatment, yet under Methodists and Pneumatists alike reckless attacks upon disease by powerful drugs prevailed more and more; and unhappily the influence of Galen did little to discountenance them. By the Hippocrateans emetics had been used more rationally, and in moderation also by Asclepiades and Celsus, who prescribed them in bilious constitutions, and for certain chronic diseases. Asclepiades indeed gave warning that abuse of emetics led to loss of appetite, atony of the stomach, indigestion, and emaciation. Nevertheless, vomitives won their way under the Empire and, as an instrument of gluttony, became almost habitual. These agents were many in number, ranging from a feather in the pharynx to a pound or a pound and a half of radishes in a horrible mixture with honey, salt, and vinegar; the oxymel of squills being another mawkish alternative.

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[1] *Vide*, e.g., *Die Halskrankheiten bei d. altgriechischen u. romischen Ärzten*, von J. Weigel, Leipzig, 1907.

[2] It is a curious feature in Aretaeus (ed. Adams, p. 123) that he describes at length the elephant from which the disease took its name. Why? Again as a transcriber? Oppian gives this same description, one copied, it is said, by both writers from Amyntianus' Περὶ ἐλεφάντων; a book referred to by a scholiast on Pindar (*Smith's Dict.*).

While referring to the use of hellebore in insanity I may say not inappropriately that on the treatment of mental disorders Archigenes, like most Greek physicians (p. 276), seems to have held opinions of remarkable enlightenment. Seeing the priests of Cybele scampering, and flagellating, and cutting themselves after their manner, he said, "they are insane, do not leave them to those bloody gods of the East, send them to me." And his therapeutics was no less enlightened, for he fed up the maniac and soothed him with music. What would Bedlam have thought of this eccentricity!

Archigenes, as reproduced by Aretaeus, had a considerable knowledge of the veins and ducts of the liver, and wrote well on phthisis, and on diabetes, which was regarded as a melting down of the flesh into urine—a sort of runaway dropsy. And of the anatomy and diseases of the nervous system his knowledge was considerable; for instance, he seems to have been the first to show that hemiplegia falls upon the side opposite to that of the cerebral lesion; moreover he attached the aura to epilepsy. In his description of tetanus Haeser thinks a note of cerebro-spinal meningitis is to be detected. He recognised also the glandular nature of the kidneys, of the testicles, and of the mammae. One remark of Archigenes might, after the lapse of all the centuries, come as a fresh light to the modern examiner: "What we need is to be fertile in expedients, not to be always paying attention to the writings of other people."[1] Loeffler states that in this author is the first mention of diphtheria. Loeffler was probably unaware of the doubtful date of the work; but he says diphtheria is not to be fully identified in Hippocrates, Celsus, Soranus, Galen, or Caelius Aurelianus. It was supposed to have been imported from Egypt and Syria. We have also in Aretaeus masterly sketches of smallpox, phthisis, diabetes, certain palsies, and so on.

The surgery of Archigenes—whose fame, says Dr. Withington, was no less honourable as a surgeon than as a physician—and that of other Eclectic physicians of this period, presents a very fair story. The ancient Greeks shrank from mutilation: and amputation, mentioned by the Hippocratean physicians only in gangrene as a subsidiary aid, seems, even in Alexandria, to have made no great progress; for Celsus also regarded it as a last sad resource in gangrene: yet by the time of Trajan, under Archigenes, amputation had become a recognised procedure for ulcers, growths, injuries, and even for deformities. The limb to be removed was bandaged to expel the blood, and a tourniquet was placed above the line of severance; or sometimes the chief blood-vessels were first cut down upon and tied, and the smaller tied, or twisted, during the operation—"transfixing them with a sharp hook and twisting them round and round and closing them by this twisting"[2]—a proceeding of which there is no trace in Hippocrates, nor apparently in the earlier Alexandria. These good methods were afterwards obliterated by the bad fashion of the searing-iron. But we know that Galen used the ligatures, even at what shop he bought them. Moreover, as we noted under Soranus, the whole field of surgery had come under a more intensive cultivation. Still, if it be true that in Alexandria major operations had not made much way, yet by the traditions of Apollonius of Cition, of Lysimachus of Cos and other Hippocratean commentators, of Apollonius Mys (a Herophilist from Alexandria), of Dioscorides, and especially of Philoxenus, we learn that nevertheless in that anatomical school surgery was carried forward. Aretaeus is good on urinary diseases, and in cutting for stone and operating for hernia, operations which, before and afterwards the prey of specialists and adventurers (p. 345), seem then for a while to have been undertaken by the surgeon. Heliodorus practised resection of the long bones. How much of the more advanced surgery under the Empire was due to Romano-Greek physicians, as, for example, to Heliodorus and to that evasive shade, without local habitation, Antyllus—a personage who probably owed much to Heliodorus but of whom we have little more than a glimpse in Oribasius—and how much of it flowed derivatively from earlier sources, we cannot definitely say; but the progress seems to have been substantial and largely original. Paul copied freely from Antyllus, and probably took from him the well-known section on Aneurysm.

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[1] *Χρὴ δὲ καὶ αὐτόν τινα συνευπορέειν, μὴ πάντα ἀλλοτρίῃ ξυγγραφίῃ προσέχοντα τὸν νόον.*

[2] Περιστρέψαντες πολλάκις καὶ ἀποτυφλώσαντες αὐτὰ διὰ τῆς περιστροφῆς, Lib. I. c. 4. *Vide* Daremberg and Bussemaker's edition of Oribasius, excerpts from Heliodorus's great *Χειρουργούμενα* in five books.

Out of such fragmentary and allusive records as I have tried to stitch together, recent historians of medicine, and Wellmann especially, have endeavoured to reconstruct the figure of the great Eclectic Pneumatist, of Methodist origin, Archigenes of Apamea; a figure not wholly eclipsed in the transit of Galen, for in the sixth century his memory was still revered by Alexander of Tralles as *θειότατος εἴπερ ἄλλος*. That Juvenal speaks of him as a fashionable practitioner need not derogate from his merits, as we pleaded in the life of his greater predecessor Asclepiades; and as we might have to plead for some fashionable physicians of our own day, who, wise men as they are, do not disdain empirical and persuasive remedies when no arm of precision is at hand. Archigenes seems in character to have been a blend not only of several schools of doctrine, but also of several complementary qualities: of theorising proclivity, yet rational in methods and technically sound in practice. To his clinical insight the fruitful distinction between primary and secondary disorders, and the indication of localising symptoms, which I have quoted from Aetius, is strong testimony. If, on the one hand, it appears from Galen's respectful criticism, and from other witness, that, after the fashion of the Pneumatists, he was in preciosity of language and in sophistical dialectic something of a pedant, yet, on the other hand, he did much to deliver medicine from the cramping influence of the Methodist common forms based upon an abstract principle, like the "homoeopathic" formula which in our own day became for a while so dear to that most theoretical of creatures the "practical" man. Nay, if besides he seems, like Alexander of Tralles, to have fallen in with the use of amulets and suchlike, probably it was as a tolerant and humorous observer of the foibles of mankind, and of the magical influences of faith, rather than as a charlatan or a sorcerer. Last, but not least of the distinctions of "Aretaeus," one for which he should have the immortal honour of mankind, is that (as Diepgen says) he first—for here even the great Hippocrateans are found wanting—he first taught sympathy for the sufferers from incurable disease.

Of the Eclectic pupils of Agathinus there was at least another of high and well-merited repute, namely *Herodotus*. In Paris there lies, as yet unpublished, an anonymous manuscript, found at Mount Athos which by some commentators has been attributed to Soranus, by others to Themison.[1] It is entitled *Περὶ τῶν ὀξέων καὶ χρονίων νοσημάτων*. Daremberg knew the MS. and alluded to it in his Oribasius. The treatise is to appear among the *Medici minores selecti* of the Corpus Scrip. Med. Meanwhile Wellmann had studied the MS. and published a careful review of it.[2] The treatise contains valuable materials for the history of doctrine, and in it Wellmann has detected some clews to the problem of authorship. He finds parallel passages in Galen (xi. 559) and fragments of it reappear in Aetius. Of its quality Wellmann speaks in high commendation; it is simple, clear, and masterly. The author has been accused of copying from Philumenus; on the contrary, says Wellmann, Philumenus copied from him; his date, early in the second century, must be put after Soranus and Archigenes, but before Philumenus. As the author accepts the *ἔμφυτον πνεῦμα*, he was not a Methodist, but a Pneumatist or an Eclectic, probably an Eclectic. Now Aetius says plainly that Herodotus was one source of Philumenus, in some parts of whose compilation we find passages in which the style and some remedies reappear in such fragments of Herodotus as are extant. For these and other reasons Wellmann thinks we may be justified in regarding the Paris MS. as a part of a treatise by Herodotus, who in his etiological paragraphs was indebted to Soranus (see Aetius ix. 50). If their attribution prove to be correct, medical history will be enriched by a precious document. We may hope the publication of it will not be long delayed.

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[1] See Fuchs, *Rhein. Mus.* N.F., Bd. lviii., 1903.

[2] Max Wellmann, "Herodotus' Werk *Περὶ τῶν ὀξ. κ. χρ. παθ.*," *Hermes*, xl., 1905; and xlviii., 1913.

Finally, in this vindication of the place of Archigenes in the current of history, I must refer again to Philumenus. In his Περὶ *τῶν ἰοβόλων ζώων καὶ τῶν ἐν αὐτοῖς βοηθημάτων*, he drew largely upon him, as he did upon Herodotus and less eminent men of the school of Athenaeus and Soranus; and this not least in respect of poisons and their antidotes. I propose to give some sketch of the Greek tradition of the poison literature, which, more or less mingled in its course with that of cosmetics, may be traced back to one Apollodorus of Alexandria (*c.* 300 B.C.); thence in dark volume it flowed through Nicander, Philinus, Andreas, and that remarkable man, who so often claims our attention, a Herophilean turned empiric—Heracleides of Tarentum. We shall see in a later chapter that Crateuas is a very important link of this chain. With him we enter upon the Attalid and Mithridatic period of this art and mystery on which the *locus classicus* is the twenty-fifth Book of Pliny's *Natural History*; and so to Dioscorides, to Philumenus, to Aetius who borrowed from Philumenus, and to Galen. Thus, if at second hand, Archigenes became a main source of this sinister lore for the Middle Ages, and for the papal and ducal circles of the Renaissance.

CHAPTER XII

RUFUS AND GALEN

In the history of ancient medicine we often find ourselves in the presence of shadows of great men who survive for us only in their works, or in fragments of second-hand renderings of their works; in a few cases indeed, as of Archytas, only as names of renown. We do not know that *Rufus of Ephesus* ever entered Rome; we do not precisely know when or where he flourished. Daremberg[1] was of opinion that, for a time at least, he resided in Rome. Like most of the ancient physicians he travelled widely. At Ephesus no record of him has been discovered. However, in a sketch of Medicine in the Roman period we cannot omit some tribute to a physician of that era, a physician of the tradition and spirit of Hippocrates, whose large experience, power of mind, philosophic learning, breadth of view, exactness of method, and relative proficiency in anatomy have established his fame in history. He speaks of himself as inclined to anatomy but having had no opportunity of pursuing this study in man. He dissected apes (probably Macacus), as Galen did.

Apparently Rufus flourished in the time of Trajan, but after Archigenes, whom he quotes.[2] Yet, as Wellmann himself has pointed out elsewhere, we find in his writings no traces of "pneuma," nor "of methodism." Galen, who seems to have known his works only at second hand, speaks of him,[3] with great respect, as a recent author (νεώτερος); one well instructed in Hippocratean medicine, a good anatomist, and a sagacious physician. Oribasius calls him the great Rufus.[4] His fair anatomy points perhaps to Alexandria, or possibly Smyrna, as his school. He discovered the optic chiasma, demonstrated other features of the nervous system, and emphasised the function of the nerves as mediators. He put both blood and pneuma in the arteries (p. 309). In practice he was eminent as a surgeon and gynaecologist. Galen approves his treatment of melancholia. He described suppuration of the kidney. As literature his work is clear, concise, and interesting.

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[1] Daremberg, *Hist. of Sci. Med.* i. 190.

[2] See Wellmann (art. "Diocles"), *Hermes*, 1912. Menius Rufus, the contemporary of Cleopatra, was another person.

[3] *De atra bile*, ch. 1.

[4] Γέγραπται δὲ καὶ Ῥούφῳ τῷ μεγάλῳ κτλ., *Emp. Preamb.* ed. Dar. v. 560.

So much as is extant of the works of Rufus is nearly all contained in Oribasius, Aetius, Paul, and Rhazes (Continent). Among the Arabs Rufus had a great vogue. Four works survive in a more or less complete condition; namely, *On Diseases of the Bladder and Kidneys*; *On the Names of Various Parts of the Body*; *On the Gout*, known only in the very interesting Latin version (Podagra) of the seventh or eighth century; and *On Purgative Remedies*. The smaller fragments, taken from Galen, Oribasius, Aetius, and elsewhere, are many. From Rhazes Daremberg collected 377 fragments of Rufus (as also of Antyllus, Philagrius, Archigenes, Philumenus, etc., etc.), but of course many of these are at second or third hand; or unauthentic. The authenticity of the book on *The Pulse* (ed. Daremberg, 1879), long attributed to Rufus, is contested; the chief argument in its favour is that it is ancient, not later than Plutarch, and presents points of agreement with the anatomical work of Rufus.

It seems clear that Rufus was one of the few really independent physicians after the Christian era yet of Hippocratean clinical tradition. Oribasius (ed. Dar. iii.) reports a humorous remark of Rufus, that the songs and dances of the women not only honoured the gods, but were also good for their own health.

To undertake a series of lectures on Medicine in Rome without some story of *Galen* would indeed leave a void; on the other hand an attempt to appreciate Galen as a physician, a man of science, a philosopher, and only too paramount a leader of thought, if not, in the present state of our knowledge, premature, would be an ambition far beyond our present reach. Omitting the well-known outlines of his history, reflecting rather on his life and work as a whole, I may say, summarily, that Galen was born at Pergamon in the summer of A.D. 129, and, after a visit to Rome in 162, returned to reside there in 166.[1] In Pergamon probably, Galen was nurtured in the Alexandrian tradition by Satyrus, a pupil of Quintus (Κόιντος); the *ἀνὴρ ἀνατομικώτατος* of that time, and also a pharmacist. His teaching was oral only (Gal. xv. 36), but he was known to be an opponent of the Empirics. In Smyrna Galen certainly was a pupil (see Gal. xix. 16) of Albinus and Pelagus, also disciples of Quintus. There were many of these late Alexandrian teachers in the Aegean cities; Pelops also was teaching in Smyrna, and Numesianus in Corinth to whom also Galen resorted. These men were probably, Quintus certainly, pupils of the great Alexandrian anatomist Marinus (Gal. xviii. B. 926). Thus the tradition of Hippocrates, to which Galen was devotedly attached, flowed through Praxagoras of Cos to Herophilus of Alexandria—an antagonist in opinion of Erasistratus (p. 146), and from Herophilus, through the shadowy authors of whom I have just now spoken, to Galen. Hence Galen's opposition to Erasistratus who protested in favour of physical therapeutics and against polypharmacy.

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[1] These dates, and some inferences concerning his commentaries and other details of his work, were ascertained in one of the excellent dissertations of Kalbfleisch's school in Marburg. The date and author's name I have mislaid.

I have said elsewhere[1] that it was the custom in Greco-Roman medical circles for aspiring physicians to deliver public lectures, or addresses, of which a few examples have come down to us; one or two even in the Hippocratic Corpus. Galen thus lectured to large public audiences, and in the presence of distinguished men. We read that a great-grandson of Sergius Paulus, who was governor of Cyprus *c.* A.D. 46, attended Galen's lectures in Rome (*Class. Rev.*, 1919, p. 8). As he had no lack of self-confidence, he built up by this and other assiduities, a great practice. His industry and prolixity, both in authorship and in life, were prodigious; volumes of manuscript flowed from his pen, treatises on philosophy, science, and practice; and he travelled widely, proclaiming, disputing, and also achieving much admirable work. I have described him[2] as a man of enormous industry, great sagacity, and unbounded fluency. His was one of those ebullient natures which, richly endowed with talent, and even with genius if not of a very original kind, with quick perception and boundless self-confidence, took a long while to find itself, to emerge from more or less frothy speculation, schematic logic, and artificial philosophy, into the riper, sounder, and more fruitful researches of his later years. Vaunting as he was, he had in him also a

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[1] Page 448, chapter on Public Medicine; also *Classical Review*, June 1915

[2] *Ency. Brit.* art. Med.

temper of honest and tireless labour, a love of truth,[1] and this much of genius that, in the midst of his intellectual gyrations, he took no light hold on the saving principle of inductive research, even the experimental method of that master key of science,[2] and formed such true conceptions as that (in the treatise Περὶ φυσικῶν δυνάμεων) of the specific affinities of the several organs for the various elements of nutrition and secretion.[3] Although a far smaller man than Aristotle, yet these two illustrious ancients were alike in their conviction that search for facts and their verification made the foundation of science. To judge from the few records we possess of Alexandrian study, it may be that in this insight the Alexandrians made no advance upon Aristotle; they were admirable observers; but although methodical experimenters in physics, they were not so in biology. As Galen's methodical experiments upon the nerve roots and segments of the spinal column, on the visceral sympathetic, and on the several effects of a series of sections between the first and second vertebrae and so downwards, upon the respiration—intercostal and diaphragmatic, the voluntary movements, the control of bladder and rectum, and cutaneous sensation,[4] are well known, I will turn for an illustration of this virtue in Galen to another and less conspicuous research. In his investigation of the muscles [5] which before his time seem to have been imperfectly known, even to Marinus, Galen used both the observational and the experimental methods, and moreover the comparison of normal with pathological conditions. He was surprised to find crosswise fibres in the myocardium, as everywhere else they were longitudinal. It was partly for this reason, and in part because it was not under the governance of the will, that Galen denied that the myocardium was a muscle (p. 305); thus falling short of the Alexandrians and many before them. He enumerated some 300 muscles (Περὶ μυῶν ἀνατομῆς). He demonstrated contractility in every part of a muscle, even in the dead body, and this he attributed to a specific tissue—

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[1] In his enthusiastic praise of Posidonius Galen set forth above all his zeal for truth before dogma.

[2] Roger Bacon's *Scientia experimentalis* (see Bridges' Introd. R. B).

[3] See C. A., *Class. Rev.* Nos. 3-4, 1917.

[4] The distinction between motor and sensory roots and ganglia was left to Magendie.

[5] For calling closer attention to these and other of his researches we are indebted to Meyer-Steineg, *Studien zur Physiologie des Galens.* He points out the need of a comparative study of Galen's biology, and demonstrates Galen's identification of the cerebral nerves.

the sarx. He further distinguished this specific contractility from the ψυχικὴ δύναμις or ψυχικὸς τόνος—the psychical influence or tone—which was the brain regulation of it; really a masterly argument. Galen's strong foundation in human osteology may have been laid in study of skeletons obtained from Alexandria (see Tr. Περὶ ὀστέων). Incidentally time after time, on points in dispute, he appeals to his opponent to betake himself to experiment —to "try"; and tells him how and what he is to do and observe (*e.g. Nat. Fac.* iii. 8). Guy of Chauliac was fully justified in his eulogy of Galen, "fuit enim maximus in scientia demonstrativa."

Steineg (*loc. cit.*) after setting forth the physiology of Diocles, Praxagoras, Herophilus, Erasistratus, then surveys Galen's anatomy—morphological, motor and sensory, and the rest; and justifies much of Galen's great reputation. At the same time it is apparent in not a few places that his anatomy was only that of animals;[1] dissection of man being then out of the question. Diseases of the throat and larynx, especially in the infections, as we well know, occupied much of the attention of early physicians; and from the time of Hippocrates much progress was made in this part of medicine; a progress to which Galen, both by the study of man and animals, made valuable contributions. He produced palsy of the larynx by cutting or tying the recurrent nerve (Kühn ii. 841), and contrasted paralytic aphonia with locally caused hoarseness or loss of voice (vii. 150); three pathological cases of palsy of the recurrent are narrated.[2]

Simon's edition of seven books of Galen's anatomy, with an essay on the whole subject, is within its limits a monumental work; the subject had never before been dealt with so thoroughly, in such good form, and so critically; and in none of his works does Galen show himself to more advantage. As Ilberg says,[3] it represents the best side of Galen; it declares his industry and good faith, and his moving by experiment from one position to another. Like Harvey he exclaimed again and again—Look and try for yourself (αὐτὸς αὐτόπτης). His dissections were precise, and he used vivisection with intelligent purpose;[1] for instance, by tying the ureter he confuted Asclepiades' foolish notion of the condensation of a urinous vapour (p. 173). Haeser says, it is true (3rd ed. p. 249), that a large part of the contents of his chief anatomical treatise, the *Περὶ ἀνατομικῶν ἐγχειρήσεων*, Galen borrowed ("wesentlich entlehnt"), through Marinus, from Alexandrian teachers, some of the most assiduous dissectors of ancient times; but, as all the works of Marinus are lost, this can neither be asserted nor denied. The works of Erasistratus and probably of Herophilus were lost before Galen's time. All anatomists must accept and continue the work of their forerunners, and in the growth of both anatomy and physiology Galen did his full share; moreover he fully acknowledged the thoroughness and extent of the Alexandrian anatomy, both normal and pathological. Unfortunately for himself as well as for the world, his anatomy, the anatomy of apes and pigs, was for many centuries taken in the lump as final and infallible. Indeed thenceforward anatomy was a closed chapter till the day of Mundinus; and he was but a pig-anatomist. It is clear then that Galen was an intelligent anatomist, quick to see analogies and relations, even developmental relations; as for instance the common origin of the male and female organs of generation. He also taught the value of topographical anatomy; and in respect of bones and joints, as well as of motor and sensory nerves, did excellent work. For lack of any method of injection in his time the anatomy of the blood-vessels was less advanced.[2] Furthermore, bemused as his teaching too often was by *a priori* speculations and teleological prepossessions, nevertheless he cast aside the oriental cosmogonies, unconditioned and based upon the fiat of God, and accepted an order conceived under uniform and immutable laws. On the other hand he was opposed to biomechanical speculations, and regarded each living organism as the work of a creative artist. In physiology I have said that Galen's hypothesis of the Natural Faculties,[3] of the attraction by each organ of the materials proper to it (*όλκὴ τοῦ οἰκείου*), the retention and conversion of these into its own kind (κατὰ τὴν ποιότητα κινεῖσθαι) and specific activity, and the rejection of those alien to each (τὸ ἀλλότριον), or περισσώματα—a doctrine absolutely destructive of homoeomerism (p. 174)—if sometimes fanciful in analogy and illustration, proves his insight and theoretical capacity.

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[1] Thirteen centuries later Leonardo, so it is said, was expelled from Rome for his dissection of a human subject.

[2] See W. Gordon Holmes, *Hist. of Laryngology*, 1884. As these observations are scattered through Galen's works we have to thank Dr. Gordon Holmes for his careful collection of them.

[3] "Aus Galen's Praxis," J. Ilberg, *N. J. klass. Alt.*, 1905, vol. xv., an able and comprehensive criticism of Galen's life and works to which in a measure I am indebted; but I think Ilberg judges Galen too harshly, and too much on literary and philosophical grounds.

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[1] See also von Töpley's Anat. works of Rufus and Galen; in numbers, published at Wiesbaden. I have only had in my hands No. 96 which contains the anatomy of the arteries.

[2] For Galen's belief that the arteries contained blood, see p. 309.

[3] This treatise (*Περὶ φυσικῶν δυνάμεων*: he deals with four) has been translated, by Dr. Brock, for the Loeb Series (New York, 1916). See notice by the present writer in the *Class. Rev.*, 1917.

On the pulse he was led astray by his fussy dialectic. It is curious that, like Harvey, he saw a human heart in action, in the case of a boy who had lost some ribs by caries. It is not generally remembered that he inferred the passage of the arterial into the venous system from the effect of haemorrhage from any one vessel; that it drains the whole vascular system.

In accordance with his anatomy Galen must have been a better surgeon than is usually supposed, a vindication I have tried to make for him in a former book.[1] In Rome however it was becoming the custom to send surgical cases to professed surgeons, a custom to which Galen had to submit. As modern surgeons, such as Carrel, have reaffirmed to-day, he insisted upon the clearance of all pockets about a wound, and on the securing of clear and free drainage.[2] In all these respects again Galen was a great man. To literary scholars, such as Ilberg, Wellmann, and Wilamowitz, to whom Galen's vauntings and argumentative prolixities are but too apparent, these investigations may not appear in their full value; their value is better appreciable by the physician. If it is right enough that Ilberg, as a literary critic, should bring Galen down from Olympus and show him as a child of his age, or even something of an audacious Greekling from Asia, a world-wandering polyhistor of quick perception and ready tongue, it will not be forgotten by the medical reader that, in the sphere both of science and clinics, he was far more than this. He was something greater still, and far better, than "a great compiler."

Whence did Galen obtain that intimate knowledge of Hippocratic writings which again did no little honour to his sagacity? Although it is true that he complained (xv. 67) of grievous losses of the works of his predecessors, especially of Chrysippus and of Diogenes of Apollonia, and acknowledged his debt to Rufus and others who quoted them, yet, it would seem that copies of the Hippocratic Corpus were still to be found in all the larger medical schools (p. 160 *n.*). Moreover Galen probably received this tradition directly from the successors of Quintus in Alexandria. Besides his loyal devotion to the name and school of Hippocrates, Galen was himself an ardent, only too ardent, humoralist. He relied also upon the Critical Days, a doctrine, neglected if not repudiated by Asclepiades and the atomists, which, if a remnant of magical numbers, was rationally fortified by the periods of pneumonia, and typhus—maladies then frequent, and of the malarial infections which also tainted many other diseases of the Mediterranean. The Methodists did recognise crisis; what they denied was that crises were determined by calculable periods. How fully Galen accepted the four elements and four humours we know only too well; and of them, by permutations and combinations, crases and dyscrases, concoctions, complexions, and temperaments, he constructed an elaborate logical system. However, under the inspiration of the epoch-making work of Hippocrates on *Airs, Waters, and Places,* he enlarged the field of his cruder pathology by having some regard to the "non-naturals" or extranaturals; to mode of life for instance, to housing, climate, and so forth. Again in his three books on the Crases he emphasised, as did all the Greek schools, the duty of treating the individual, not narrowly the local lesion, or disease. Unfortunately Galen's works fell on bad times, on what Scaliger called the "tempus ἄδηλον"; his logical and dialectical system became a bondage of the letter, drifted into hollow logomachies, and, finding their way into the great Arab cyclopaedia of Alkindi of Bagdad, and so by Arnold of Villanova and Bernard of Gordon into the West, and becoming stereotyped in that meagre handbook of medieval medicine, the *Ars parva,* enthralled medicine for ages in their fetters. The price we pay for our great men is that later generations make tyrants of them. More justice was done to Galen by such editors as Günther ("Winter") of Andernach, an M.D. of Paris (1487–1574) who studied at Deventer and Marburg, became Professor of Greek at Leyden and Paris, and did brave work as a translator. Thence, on turning Protestant, Winter had to fly to Metz, and to Strassburg, where Vesalius sat under him, and where he practised as a physician as well as professor of Greek. He lectured on Hippocrates and Galen, and translated much of Galen.[1]

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[1] At the age of twenty-nine he was appointed surgeon to the gladiators at Pergamon; no idle office.

[2] It is agreed that by ἕλκις Galen meant any open wound, any superficial lesion of continuity. For his gynaecology see Lachs, *Abh. Gesch. Med.*, 1903.

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[1] He translated also Oribasius, Alexander Trallianus and Paulus; and was the first to publish the second part of C. Aurelianus.

Payne agreed with Haller that Galen's best clinical treatise, perhaps the one of most original merit, is the *De locis affectis* (*Περὶ τῶν πεπονθότων τόπων*), to which I have alluded; a work edited and translated with fine and mature judgment by Daremberg. The various organs are interestingly discussed *seriatim* (viii. 29) with the respective signs and symptoms of their disorders; but necessarily with no morbid anatomy. However maladies were thus from vague generalities brought down to definitions. For example, after divining the infective propagation of phthisis, he divided the disease conveniently enough into three varieties; the non-pyrexial, the pyrexial, and the ulcerative. Again he showed his insight in declaring that jaundice was a symptom, not a disease.[1] Three or four other treatises from his hand deal with the same subject; among them those on *Differential Symptoms*, on *Differential Diagnosis*, on the *Causes of Symptoms*, and on the *Causes of Diseases.*

Yet as Galen's pathology was founded upon his theory of temperaments, and this upon the Hippocratic doctrine of humours, he left himself plenty of scope for the larger expatiations. Health depended upon the eucrasia of the four qualities; disease, or rather the occasions of disease, upon a faulty crasis, an intemperies or "distemper." This system was worked in with external causes and woven into a logical fabric with extreme ingenuity; no phenomenon was without a name, no problem without a solution.[2] In Rokitansky, one of the teachers of my youth, on whose works many of us older men were nursed, no little remnant of it survived. Although Galen developed the Stoic attribution of the varieties of human character to the various admixtures of the four humours, yet the names "choleric," "sanguine," "melancholic," and "phlegmatic" were not introduced until the ninth century by the Arab physician Johannitius (Honein ben Ishak). They were carried forward into common use by Honorius of Autun (see *Class. Quart.*, Jan. 1919). But Aristotle had asserted that the dispositions of men depended on the conditions of the *atra bilis* in their bodies. However, Galen's measure of pneumatism modified his humoral doctrines; *e.g.* gastric digestion was a specific *πεπτικὴ δύναμις*, as did his far more scientific concentration upon local lesions as causes of disease. He was not indeed without a tincture of the Methodism which he repudiated; for instance, in his *materia medica* he made the division into astringents and relaxants. He taught that the psychic pneuma was distilled by the choroid plexus from the finest elements of the carotid blood and centrally was stored in the ventricles, whence by the nerves it was distributed through the body, driving the whole machine. But the brain was the seat of the "logistic psyche," and of sensation and motion. The brain purified itself (as his predecessors had supposed) in great part through the cribriform bone, nose and throat, but of its finest reek through the sutures. On insanity and hysteria he wrote well.

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[1] See however Aret. *M. Chr.* i. 15: jaundice is an inflammation of the common bile duct; and if with fever is mortal.

[2] See the writer's Art. on Medicine, *Ency. Brit.*, last edition.

Pneuma, for Galen, was not innate but acquired (ἐπίκτητον), and consisted of, or in, air nourished, according to the ancient belief, by the evaporations from the bodily juices (ἀναθυμίασις p. 226). He regarded the *spiritus animalis* (πν. ζωτικόν) as a stream from the brain, not soul (ψυχή) but the organ of it. The vegetative spirit (πν. φυσικόν) he placed in the liver ("second digestion") whence, mixing in the lungs with the animal spirit, it was carried by the pulmonary veins to the heart.[1] We have seen that Galen was quoted by Huxley, in an *obiter dictum*, as a source of pneuma-lore, and as apprehending the idea of animal heat by combustion, but of his conception of the respiration and circulation I have spoken at length already (p. 259 and elsewhere). But herein, as we have seen, Galen was no pioneer, he did but adopt or report the notions of his predecessors; to this subject he contributed nothing but some confusion.

In his Therapeutics Galen's inclination fell strangely away from the breadth of Hippocratic and Erasistratean treatment of disease, with their reliance on the resources of nature. The Dogmatic tradition through Diocles and Herophilus, fortified his contra-Erasistratean faith in venesection, and in the drug medication fed by Egypt and the East. Indeed his treatises on pharmacy and *materia medica* are of little importance, except as sources of the perennial drugging which even now we have not shaken off. One of the longest—the *Method of Therapeutics*—was translated by Linacre into latin. It was not that Galen altogether forgot nature's bias to recovery. Life, he said well, was the sum of external influences upon a normal material constitution; but, as regards the physiology of respiration for instance, Asclepiades had carried to Rome a far more enlightened sense of restoration of the balance of functions by physical means, by modifications of the external conditions. Galen, though he did treat fevers by tepid baths, was heavily pharmaceutical; too disposed to forget his physiological and pathological methods in a search for specifics, and thus to accumulate recipe medicine. *Populus remedia cupit.* (Θεῶν χεῖρες εἶναι τὰ φάρμακα, Kühn xii.) (see p. 35). His principle was cure by contraries, and his drugs were classified by the four qualities—hot, cold, moist, and dry. In these vagrancies, as he lost touch with facts, he spun more and more webs of dialectic, rhetoric, controversy, and egotism; so as now and then almost to remind us of Paracelsus. Thus his qualities found the readier acceptance in Byzantine cities; in the Latin world Galen founded no school.[1] By the Arabs Galen was regarded as second only to Aristotle.

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[1] The following passages may serve as illustrations. In the *De usu part.* lib. vi., towards end of discussion on pneuma and foetus in utero, he says: "But the arteries receive the pneuma, from which the innate heat can be derived, by anastomoses from the veins." Again: "The arteries contain a thin, pure, and vaporous blood." In the *De meth. med.* he says: "But the vital spirit is contained in the heart and arteries, and is nourished in part by the inspired air, in part by the exhalation of the blood."

As a disputant, and in his day truth was sought in controversy, Galen was voluminous, pertinacious, and at times bitter; if not without cause he scoffed at the outworn phrases of Methodism, he failed to discern the merits of individual Methodists. It is fair to add that Galen found Medicine split up, distracted, and disintegrated by factions, and abased in social esteem. Yet in spite of Galen, Methodism, in a skeleton form, persisted down to the fourth century, and reached the Benedictines of Cassiodorus; much of it passing under the popular name of "Aurelius" (*i.e.*, Caelius Aurelianus, Soranus, etc., p. 215).

As a philosopher Galen won his way by his scholastic system; he attributed all the marvellous adaptations of nature to God as a demiurgus, a divine craftsman, thus withstanding the invasion of demonology; but how his ardent and highly elaborated teleology, by endearing him to Aristotelians—on the arguments of whose master he insisted—to the Stoics, to the Church, and likewise to Islam, fastened his yoke upon Europe, not in medicine only, is an old and long story which is not our business here.[1] In short, as in the *De usu*, Galen virtually submitted the divine to the human intelligence, and turned any incidental result of the coadaptation of an organism and its conditions into its end. Teleology implies a complete knowledge; design and uniform causation are two different ideas, a difference which Aristotle failed to bring out. Neither he nor Galen distinguished between cause and kind. If the teleologists would confine themselves to this Aristotelian saying—that the nature of a thing is what it is normally destined to become—we should have no quarrel with them. The pneuma he interpreted in the Stoic pantheistic way, but he held that the soul's health depended upon that of the body; indeed he almost affirmed that our opinions are results of our physical condition. On the other hand he contested some of the Stoic universals, as it would seem not quite consistently; for instance he maintained that qualities are not corporeal (*ὅτι αἱ ποιότητες ἀσώματοι*, etc.).

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[1] For the preservation of Galen's works we are largely indebted to the Nestorians in Persia and Syria where, to this day, they are held in great respect.

Perhaps the chief attraction of Galen for the neo-latin and Middle Ages was his systematic theory of Medicine. To this day students are attracted by dogmatic teaching. This Galen gave to later generations only too completely. As Meyer says, for Rome Galen was an episode; for the Middle Ages an epoch. Beside the spacious opportunities of the permutations of elements and humours, he worked in the tonics and relaxants of the Methodists, and the ethereal virtues of the pneuma. In the balance of the humours perfect health consisted; unequal balance tended to disease, but through the attractive pictures of the "temperaments." The periods of disease were marked out, not as by the Hippocratics—crudity, coction, and excretion—but as rise, acme, and fall; and the critical days were made more popular if less physiological, by being attributed to the influences of Moon and Sun. Then excreta were assigned to each of the three digestions: the stools to the first, or hepatic; the urine to the second or purification of the blood; and the third (in tissue assimilation) to the sweat. If in later ages Galen's really great qualities and important discoveries were enormously inflated, even to infallibility; yet after all he was the greatest master of scientific method from the second century to Roger Bacon.

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[1] His two Christian allusions are in the *De usu partium* (xi. 14, iii. 905, Kühn), and *De diff. pulsuum* (ii. 4, viii. 57 a).

CHAPTER XIII

PULSE DOCTRINES

In the Roman-Greek period there is no subject in Medicine of greater historical interest than the pulse doctrines.[1] The author of the Περὶ πνεύματος says that the motions of the pulse are perceptible to the senses whenever we touch the body.

Broadbent, in the introductory chapter of his treatise on the Pulse, set forth the Galenic doctrines sufficiently for his own purpose; but on this occasion we have to endeavour to trace, more fully and particularly, the opinions on the circulation of the blood from more ancient times; from Praxagoras of Cos, in the succession of Diocles,[2] through Herophilus and Athenaeus down to Galen, to whom we are chiefly indebted for what remains of the tradition. That to feel the radial pulse had become a common practice in Rome we note incidentally in such comparatively early passages as:

> Tange, miser, venas,
> . . . nil calet hic.
> (Pers. *Sat.* iv.).

and "Et peragit soliti vena tenoris iter" (Ovid in Letter x. to Flaccus, speaking of cold and languor without fever). Chrysippus and Erasistratus observed the rise of pulse rate in fever. Galen wrote many essays on the pulse, and from his fourth, fifth, eighth, ninth, and nineteenth books, in which he gives a summary and a criticism of the various pulse doctrines from Herophilus to Archigenes (especially in the Περὶ τῶν σφυγμῶν and the Περὶ διαφορᾶς τῶν σφυγμῶν (IVth Book), from some other sources, such as a certain pseudo-Galenic pneumatist treatise, from a pseudo-Soranic tract published by Rose (*Anecdota Gr.* ii.), and again from the treatise on the pulse usually attributed to Rufus of Ephesus (p. 289), a fairly definite reconstruction of the pulse lore of the ancients has been attained. Galen's main source was a lost treatise—the Περὶ σφυγμῶν—of Archigenes, some fragments of which he quotes.

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[1] In this chapter I am indebted to Celsus; to Daremberg's *Rufus*; to the relics of Archigenes; to Wellmann's *Pneumatists*; to Susemihl (*op. cit.*); to various Aristotelian commentators, and later sources.

[2] See p. 301. There may be some occasional confusion between two persons of the name of Praxagoras; the Hippocratean and the son of Nicarchus. On newly discovered fragments see Schöne, *Rhein. Mus.* N.F., 1903, lviii. Ss. 56-66.

The first treatise on the pulse (Περὶ παλμῶν) was written by Aegimius of Elis, before Hippocrates (Galen, *De diff. puls.*); but we may take Praxagoras the Coan (*c.* 340–320 [1]), probably the pupil of Menecrates of Ephesus, a disciple of the elder Ionian School of whom we know too little, as the first physician, if not to discover pulsation, at any rate to distinguish arteries from veins more clearly than Hippocrates had done (*De articulis*, *vide* Littré), and to give the pulse some place in diagnosis and therapeutics. In the Hippocratic Περὶ ἱερᾶς νοῦσου (Littré, Sect. 4. p. 369) the author says: By these veins (from liver and spleen) we derive most of our air (πνεῦμα), for they are the vents (ἀναπνοαί) of the body that draw in the air (τὸν ἠέρα) and distribute it by way of the smaller veins; then having brought revival they exhale it. For the pneuma does not stay at rest but diffuses itself upwards and downwards (upwards to the brain where epilepsy is supposed to arise). Soon after Praxagoras his pupil Herophilus, who wrote an elaborate treatise on pulsation (Περὶ σφυγμῶν), and appears to have been the first to count the pulse, by a water-clock (p. 163), and thus to bring it definitely into semeiology, followed him.[2]

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[1] It is interesting to recollect that Praxagoras was the father of Theocritus, the exquisite pastoral poet of the Alexandrian school (p. 150). Of his friends in Alexandria were two, Nicias and Aratus, who might have been more worthy of him. Nicias was the physician of Pyrrhus, whom, if well paid for the job, he offered to poison. The consul Fabricius honourably denounced him to Pyrrhus, who promptly tanned the miscreant's skin for the seating of his chair. Aratus was respectable but second rate; a physical philosopher whose two astronomical treatises in verse became popular beyond their merits; St. Paul quoted from one of them (Acts xvii. 28). They were inferior reproductions of Eudoxus, and so far incidentally welcome to us; but were not worthy to have survived the masterly work of Hipparchus, about a century later. See G. Knaack, *Hermes*, xxix., 1894.

[2] See Bursian's *Jahresb.*, 1912, Abt. 1-2, p. 173. I append also the following anonymous press-cutting: "In the course of an address on the nerves of the heart published in the *Deutsche medicinische Wochenschrift* of August 4 Professor von Leyden mentioned, on the authority of Professor Pagel, that John Floyer (1649–1734) is spoken of as the first who employed a watch in practice for determining the pulse rate; although William Harvey (1578–1657) had already used a watch for a similar purpose. In the issue of that journal of October 6 Professor C. Binz draws attention to an earlier originator of the same idea—

What Praxagoras did was to discover, or to give more heed to, the arterial pulse; and it was about the same time that Chrysippus directed attention to the value of the pulse rate as a character of fever. Erasistratus, and Straton after him, related, and limited, the pulsation capacity (*παλμός, τρόμος*),[1] to the heart, as really Aristotle did; but unluckily Erasistratus, as we have seen, taught, after Praxagoras, that the arteries in the main were air channels only, and that their pneumatic pulsation was independent of the heart, the diastole an inherent expansile energy, the systole a mere rebound; a dogma which through later ages provoked many dissensions, errors, and abuses. Herophilus, Archigenes, and Galen all followed Aristotle.[2] Herophilus however may have taught that the blood was confined to what we call the veins. Littré thinks the Cnidians were disposed to put some blood in the arteries, the Coans pneuma only. Indeed Galen says the Cnidians, and

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namely, the German cardinal Nikolaus Krebs, of Cues (pronounced Cuhs) on the Moselle, well known in the history of the fifteenth century as Cusa or Cusus. Cusa's suggestion is interesting; but it seems he did not carry it out. Galileo, if I remember right, counted the pulse by a pendulum. Timekeepers suitable for pulse counting did not exist in Cusa's day; the earliest form of the watch was the 'Nuremberg egg' invented by Peter Henlein, who died in 1542. The cardinal lived from 1401 to 1464. In his dialogue *De staticis experimentis*, which he wrote in 1450, he recommended the use of the balance in scientific experimentation; and Professor Binz gives a long quotation taken from a copy of the treatise bound up with an edition of Vitruvius *De architectura*, published at Strassburg in 1543. Immediately after the following extract comes a suggestion that the respirations in health and in illness might be compared in a similar manner.

'Nonne putas, si aquam ex stricto foramine clepsydrae in pelvim permitteres, quousque sani adolescentis pulsum centies sentires et similiter ageres in adolescenti infirmo, inter aquas illas ponderis cadere differentias? Ex pondere igitur aquarum ad diversitatem pulsuum in juvene, sene, sano et infirmo perveniretur, et ita ad morbi veriorem notitiam, cum aliud pondus in una infirmitate, aliud in alia necessario eveniret. Unde perfectius fieret judicium ex experimentali pulsuum tali differentia et pondere urinae, quam tactu venae et colore urinae tantum.'

Floyer practised at Lichfield and was knighted in or before 1686. The account of him in the *National Dictionary of Biography* is by Payne, who says: 'Floyer was the first to make regular observations upon the rate of the pulse, counting the number of beats in a minute by the watch. Before his time, though other points connected with the pulse had been carefully studied, this had been neglected. The pulse-watch was merely a watch constructed to go for exactly one minute.'"

[1] *Τρόμος*, "a tremor," and *ἅλμα*, "a leaping," hardly technical words, were used more by lay writers to mean palpitation under excitement; *πήδησις* was also a leaping palpitation, as *e.g.*, in fear, Plato, *Tim.* 70. We should naturally expect that, in much ignorance of the mechanism of the circulation, such a sense of throbbing would be the primary meaning. Such was the first and general meaning of *παλμός*, a "palpitation." So *σφυγμός*, which became the accepted technical word for pulse, meant primarily the throbbing as of the blood in an inflamed part (L. & S.).

[2] For a careful and interesting discussion on the anatomy and physiology of the circulation according to Aristotle, see Prof. D'Arcy Thompson's edn. *Hist. animalium*, Oxford, 1910 (513 a); and Curtis, *Harvey on the Circulation of the Blood*, Col. Univ. Press (N.Y., 1915), a very valuable little book (see review by C. A., *Nature*, May 11, 1916).

Euryphon in particular, taught that the arteries contained blood, as did Aristotle. Euryphon was an able clinician and anatomist, and is supposed to have been in part author of the *Cnidian Sentences*, and of the *Diet of Health*. He flourished probably a little before Hippocrates.

Aristotle seems to have been unaware of the distinctions of his contemporary Praxagoras between arteries and veins, except in respect of the aorta and venae cavae. Dr. Crawford (*Harv. Or.*, 1910) thinks Aristotle first restricted the name " aorta " to the " thick artery " of Diocles. He supposed the heart to consist of three chambers, the two ventricles and the left auricle. By most of the ancients the right auricle was integrated with the " great blood-vessel " (v. cavae). Galen and many other writers, relegating both auricles to the vessels, used to speak of the heart as two-chambered. In these inquiries we are still perplexed, in Aristotle as elsewhere, by the uncertain meaning of the word φλέψ or even of *vena*; the word being used indiscriminately; as we say " blood-vessel." We have seen however (p. 148) that Herophilus and Erasistratus clearly distinguished arteries from veins, and the left from the right heart; indeed some of the Hippocrateans distinguished arteries from veins more clearly than did many later authors. Celsus, whose testimony in respect of Alexandria is very important, although he uses *vena* to signify blood-vessels (including arteries), yet uses the word *arteriae* also, on the whole with a definite meaning and, anatomically, in our sense; as for example, " itemque arteriae quas καρωτίδες vocant " (iv. 2); though with them he classes that main pneumatic channel the *aspera* (τραχεῖα) *arteria*, or windpipe. This name, it seems, we owe to Erasistratus, who also demonstrated the epiglottis as the lid of it; yet notwithstanding he gave away its pneumatic function to the arteries (p. 151).

But in all these discussions we are checked again by the looseness of terms; as ἀρτηρία may mean the trachea, so the παχεῖα φλέψ may be our aorta, or the pulmonary artery—for in the Περὶ καρδίης both are called " aorta "—or the vena cava.

The word ἀρτηρία is ancient, and originally, for the most part, signified only the trachea—this " rough artery " or air-way (Plato, *Tim.* 70 D); and, lest we be mistaken, we must remember that this use was retained in language down to a much later date; *e.g.* Galen says " this artery (αὕτη γε μὲν ἡ ἀρτηρία οὖσα κτλ.) being the organ of the voice, is the channel of the respiration, etc." (Gal. Περὶ τῶν τῆς ἀναπν. αἰτ.) Thus the tracheobronchial system was called that of the primary arteries, the aortic system of the secondary arteries; the author of the Περὶ πνεύματος seems to say that the windpipe runs on as the abdominal aorta.[1] As the adjective "trachea" gradually edged out its substantive, the name "artery" drifted to signify only those vessels we now know as such, though still it reminds us of their airy function. In the Περὶ καρδίης, a Cnidian work of Aristotelian age showing signs of Sicilian influence, the great artery (μεγάλη ἀρτηρία) from the left ventricle is distinguished from a thick blood-vessel (παχεῖα φλέψ) arising from the right ventricle "for the nourishment of the lungs." This author recognised the heart as the centre of the blood and the life, yet he also put γνώμη (φρόνησις), *i.e.* intelligence, pneuma, and innate heat in the left ventricle, and no blood. Aristotle however was more definite in the use of the word *aorta*; in the Hippocratic books this name had been often given to bronchia, but we have seen that the master, and his contemporary Praxagoras of Cos, attached the name "aorta" directly to what Diocles called the "empty blood-vessel" (φ. κοίλη), or "thick blood-vessel" (φ. παχεῖα). Aristotle knew the two colours of blood, red and blue; or bright red (ξανθόν) and darker red (ἐρυθρόν); this for feeding the body, that for the animal spirits (so Galen also and many before him); thus distinguishing them as two kinds. He made also the very remarkable observation, or inference, that in the lung the finest bronchial and vascular ramifications came not into direct communication (οὐδεὶς δέ ἐστιν κοινὸς πόρος), but alongside each other so as to provide for interchange by diffusion—the air transuding by synapse (διὰ τὴν σύναψιν). Galen however thought that the intervening tissues would prevent communication, and the Aristotelians (*e.g.* author Περὶ πνεύματος) that the air-vessel lay alongside the blood-vessel to keep it cool (see *De part. an.* γ 4. 666 b 27). The word "φλέβια" Professor Stratton, in his edition of Theophrastus (*De sens.* p. 183), translates as "blood-vessels and ducts." Succinctly speaking; for Aristotle I repeat that φλέψ was his general name for all blood-vessels.[1] Theophrastus speaks of a φλέψ containing air, the venae cavae (which with addition of the right auricle formed the μεγάλη φλέψ), being the chief.[2] The pulmonary artery was regarded as a continuation of it.

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[1] "A duct along the loins, through which breath is carried by the respiration from the trachea into the belly and out again." Jowett Fund Tr. c. 5; so formerly *Timaeus* 70, the arterial channels leading to the lungs (τῆς ἀρτηρίας ὀχετοὶ ἐπὶ τὸν πλεύμονα, etc.)."

Erasistratus (384–322 B.C.), following the author of the Περὶ καρδίης in his demonstration of the aortic valve, demonstrated the mitral valve, and described more precisely all the valves of the heart, with their mechanism and time and space relations,[3] the chordae tendineae, and the several regions of the arteries and veins in heart and liver. This he did more accurately than Herophilus, whose attention was directed chiefly to the anatomy of the brain. He recognised the muscle of the heart with its tendons (chordae tendineae), as the author of the Περὶ καρδίης had done (p. 315), and examined it closely. It is curious to read long afterwards in Galen (*De anat.* lib. vii.) that the substance of the heart is not muscular, because it is not animated by the will (p. 291).[4] Erasistratus showed by experiments that, as we shall see, blood might enter the arteries, and reaffirmed the doctrine of Empedocles on the function of the heart as the chief organ of the body and source of the blood;[5] though Aristotle had regarded it rather as a universal governor and seat of innate heat and vital energy than as the prime and singular motor of the circulation. It is true that Aristotle had perceived that the pulse arose in the heart, or at least was in unity with its function, but rather as being a seat of the pneuma. He wrote in terms of pneumatosis and fermentation of the blood (σφυγμὸς ζέσις τοῦ αἵματος) rather than in terms of a pump. Galen supposed the pulse to be primarily a *wall* motion propagated from the heart. Furthermore Erasistratus demonstrated the pulmonary circulation, so far as the pulmonary veins; but the arterial structure of these, suggesting pneumatic content, puzzled him, and he also took the pulmonary circulation to be for the nutrition of the lungs. And he still regarded the venae cavae as the chief blood-vessels. However, as he did assume some synastomosis of bronchioles with small vessels in the lungs, or transudation of juices, the great master got very near the truth of the circulation, nearer indeed than Galen, to a point of view too soon to be perverted by pneumatist and other notions for which he himself was not altogether without responsibility, or indeed to be lost sight of in the "empirical" indifference to anatomy to which I have referred. This insight of Erasistratus is of much historical importance; for, as we have seen in respect of Praxagoras, before his time, and, unless perhaps for the author of the *Περὶ καρδίης*, for Galen, and for long afterwards, the arteries during life were supposed to contain air only—thin air, breath, vapour, spirit, pneuma. It is well therefore to quote the very words attributed to Erasistratus by Galen (K. v. 552); they are as follows: *ἅμα μὲν ἀρχὴν καὶ ἀρτηριῶν καὶ φλεβῶν εἶναι τὴν καρδίαν, ἅμα δὲ τοὺς ἔξωθεν ἔσω νεύοντας ὑμένας ἐπὶ τοῖς εἰσάγουσι τὰς ὕλας ἀγγείας ἐπιπεφυκέναι, φάσκοντος.* This doctrine however Galen repudiated; for how, said he, could the blood-vessels originate in the heart when the blood for them is made in the liver? The remarkable hypothesis by which Erasistratus endeavoured to reconcile these several notions of the vascular contents was, that at certain undefined places in the circulatory tree there were communications—anastomoses—between the veins and the arteries; channels which under natural conditions he seems to have assumed to be closed—perhaps under the pressure of a pneumatic plenum in the arteries—or to be only sparingly permeable, or again to operate only vein-wise, but which in case of lesion or disease were so opened or relaxed that the blood streamed into the arteries (*παρέμπτωσις*) and became one of the causes of fever, or of haemorrhage (p. 153). If the artery were wounded, and pneuma escaped, Straton's vacuum (*ἀκολουθία πρὸς τὸ κενουμένον*[1] (p. 139)) came into action; the venous blood rushed towards, and was sucked into the empty artery, and so escaped outwards. Thus again in plethora, the blood would burst into the arteries, disturb the pulse, embarrass the emanations of the pneuma, and cause fever, local congestions, or haemorrhage. To this hypothesis, in respect of haemorrhage, we shall return, for certain therapeutical means, such as bandaging of the limbs (p. 332), were founded upon it.

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[1] I have found since that Prof. D'Arcy Thompson (ed. *Hist. an.* 513 a, Περὶ πνεύματος 1.15. n.) points out that only in the "spurious treatise" (p. 50) are the arteries distinguished as ἀρτηρίαι. "Artery" in those days generally meant air-vessel.

[2] To translate, as a recent poet has done, in the *Ajax*, ἔτι γὰρ θερμαὶ σύριγγες ἄνω φυσῶσι μέλαν μένος as a gush of black blood from the hot arteries is to admit a pardonable anachronism. Aristotle used the word σύριγξ occasionally, but for air-tubes only.

[3] Leonardo, the first modern anatomist, and the creator of precise anatomical drawings, described each valve of the heart, and explained its working. He may have foreseen Harvey's discovery; if he failed, it was for lack of surgical experience.

[4] But this must have been a verbal quibble or a vacillation of opinion, for, as we shall see, he attributed a several function of energy to the transverse and longitudinal fibres respectively.

[5] Empedocles seems also to have inferred or guessed at an interminable circulation, without beginning or end.

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[1] See Diels' *Essay on the Physics of Straton.* It is said that the "*horror vacui*" was recognised before Straton, and so it may have been, even before Chrysippus the elder. But the passage in the *Timaeus*, quoted for demonstration of this, which, Wellmann thinks, Plato owed to Philistion, is not apposite. If the reader will turn to the passage he will find that Plato is there speaking of a compressive force, as

Yet strangely enough, both as regards the physiology of the circulation, and in medicine, the Erasistrateans after all paid less attention to the pulse than did the Herophileans, probably because of their reluctance to bleed. In their clinical appreciations Herophilus and his immediate disciples seem to have been properly content with four excellent indications of the pulse—namely, size, strength, rate, and rhythm; but the later disciples of his school too sedulously and fancifully over-argued its signs, splitting them into a multitude of unreal categories. Archigenes, of whose elaborate treatise, under the title of *Περὶ σφυγμῶν* Rufus gives some account, and some excerpts of which have survived, in his recognition of eight categories only "as generally known," was economical. However his modest eight, it would seem, we must make into ten; for on turning to Daremberg's Rufus I find that "hard and soft," as qualities of "systasis and dialysis," are to be distinguished from "strong and weak," as qualities of tone. These eight, or ten, categories (*λόγοι*) at least, Galen, from his two works on the pulse and a certain pseudo-Galenic chapter, appears to have adopted, with endless subvarieties. Such minutiae as pulses hot or cold, dry or moist, etc., if in themselves idle or whimsical, are nevertheless noticeable as clews to traditions and authenticities.

When from such records as remain we endeavour to reconstruct the later pulse and respiration doctrines of the Pneumatists in the time of Athenaeus—say in the reign of Claudius—they seem to have been after this manner. The pneuma, divine energy, or world-soul, permeated the body as *πνεῦμα ζωτικόν*;

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we might say of molecular attraction or gravitation—squeezing the particles together, and driving the smaller into the interstices between the larger. The adults and children in the crowded pit of a theatre can scarcely be said to have the *horror vacui*. The early Pythagoreans spoke of the vacuum as the first phase of becoming from the infinite; but this, and such uses, were wholly fanciful. "Vacua" as "pores" belong of course to a different context. On the other hand to say that the sixteenth century took the *horror vacui* from Heron is to attach it to a link far down the chain of history.

as Erasistratus taught, it reached the heart by respiration through the lungs as *πνεῦμα ζωτικόν* and *πνεῦμα ψυχικόν*; whence the *πνεῦμα ζωτικόν* "sped like a bird" through the arteries and the body, while the *πνεῦμα ψυχικόν* was delivered to the brain (Chrysippus). Now as the pneuma reached the heart it met with the blood, both in the arteries, which had their roots in the heart, and in the ventricles; but in the ventricles crasser blood was in excess, in the arteries pneuma. "The arterial blood was thinner, purer, and redder." During all this period, in spite of Aristotle and Erasistratus, it was generally held, by Galen tenaciously, that the veins had their roots in the liver.[1] The circulation, systole and diastole, was kept up by the innate heat, identified by the pneumatists with the pneuma, as a single entity; and the harmonious rhythm of these motions was a sign of health. Thus the Praxagorean notion, that the arteries contained pneuma only, appears for a while to have been set aside; though in comparing these records we are often perplexed by equivocal terms. Galen says that Herophilus put blood into the arteries from the heart; and if pneuma also this in his view came from all over the body—pertained to universal function—and was supplied from it.[2] And here I may conveniently anticipate matters so far as to say that Galen must have accepted the truth, as the author of the *Περὶ καρδίης* had done, that the arteries contained a redder and more ethereal blood; for, as we all know, he assumed the existence of pores in the ventricular septum, pores too minute to be discerned even with a lens, through which the blood, not pneuma only, was strained from the right to the left heart. For this fancy there is an excuse which hitherto has not been made; viz. that, in the animals which, in default of human subjects, they dissected a more or less open foramen ovale is frequently seen. I have seen it frequently in the sheep, and it may be patent in the pig.

However, Galen did accept the heart as the centre and source of the pulsations, and showed experimentally that if an artery were ligatured—say the femoral—pulsation continued between the ligature and the heart, but ceased beyond it; an observation however which, if taken alone, would not have satisfied those pneumatists who attributed pulsation to the throbbing of the pneuma, or to a vibratory quality of the wall only; the diastole, as Aristotle supposed, being the operative force of the heart. Galen made further experiments from the same point of view, but the best of them failed, probably because the clotting of the blood in the vessel stopped the flow.[1] Galen says that Euryphon of Cos, the good clinician and anatomist (Galen) of whom I have spoken (p. 303), who flourished a little before Hippocrates, declared that both arteries and veins contained blood (Cael. Aur. *M. Chr.* ii. 10). So also in the Περὶ καρδίης the arteries contain blood. Still although Galen shook, he did not shatter, the hypothesis of bloodless arteries; nay, he never wholly freed himself from the doctrine. Occasionally, it is true, his words seemed conclusive, as when in *De anat. admin.* vii. he says, "Verily those who undertake to show the arteries are empty of blood utter vain and improbable opinions." Moreover he pointed out that when an artery is opened no air rushes out. The ambiguity lay in the universal notion that at most the arteries held but a portion of the whole volume of the blood, plus some pneumatic quality. The question then was whether the "arteries" contained *some* blood or none. With Galen, who was sure that the blood took its origin in the liver (iv. 547) the difficulty was to understand how Nature, "which does nothing in vain," came to make two different kinds of vessel for the carriage of it.

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[1] It is worth notice that the Chinese to this day, so I am told, think that the right pulse tells the state of the liver, the left the state of the heart.

[2] *Μήτ' ἐκ καρδίας μόνης ἀλλὰ πανταχόθεν, ὡς Ἡρόφιλος ἀρέσκει* (Gal. iv. 731 K.).

It seems to me then rather difficult in the obscurity of these traditions to discriminate between the great Alexandrians as concerns their anatomical and physiological views respectively, or indeed to compare them with precision; though it is clear that in the clinical observation of the pulse the Herophileans were distinctly in advance, as was Erasistratus in cardiac physiology; but it is probable that not Herophilus only, but also the contemporary Alexandrian school generally, attributed the energy of the arterial pulsation to the heart as the chief seat of the animal pneuma, or innate heat; certainly Erasistratus and Straton did. Moreover, herein they certainly established the important conception of the heart and blood-vessels as an integer, or functional unity, a conception in later times too often forgotten. The pulsation itself they divided into four periods—a contraction, an expansion, and two pauses. Whether both these motions or only one of them used energy seems to have been a point of some disagreement, though as the distinction between cardiac and arterial systole is often obscure, and is not always made quite clear even by Wellmann, and, as some held that cardiac and arterial diastole were synchronous, it is not quite easy to be sure of the grounds of this dissent. However, to start with, from a passage in the eighth volume of Galen (755) we ascertain that, although in the Herophilean opinion (Susemihl) the systole only used energy, the diastole being mere recoil, according to the later (Roman) school of Athenaeus energy was expended both in systole and in diastole; and the pneumatists recognised by the pulse the degrees of the tone of the pneuma. This passage being an important one I quote it in the original: *οἱ δ' ἀπ' Ἀθηναίου πάντες, ὡς εἴρηται, τὰς κινήσεις ἀμφοτέρας ἐνεργείας ἡγοῦνται, τήν τε ἐν τῷ διαστέλλεσθαι γινομένην καὶ τὴν ἐν τῷ συστέλλεσθαι.*[1] Galen taught clearly that diastole was active and operated by the longitudinal fibres of the myocardium; systole by the transverse, which he had discovered. Vesalius in the main followed Galen; but Harvey denied active diastole.[2]

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[1] See Galen's treatise Εἰ κατὰ φύσιν ἐν ἀρτηρίαις αἷμα περιέχεται (Kühn, iv. 703).

Now in some sentences it appears to me that, contrary to our customary use, by systole was intended the lift of the artery, whereas in others, as where it is disputed whether the systole of the pulse can be felt or not, clearly the arterial fall was intended. Moreover, it has been pointed out, I think on a suggestion of the late Professor Magnus, that many of these writers at any rate supposed the heart and the arteries to swell ("active diastole") and collapse together; this I had myself observed especially in the following passage: "*διόγκωσις καὶ συνίζησις αἰσθητὴ καρδίας καὶ τῶν ὁμοιοπαθούντων αὐτῇ.*" Also he says (*De puls.*) the arteries are not dilated because they are filled, but fill because they dilate. Many physicians were content to assume, as Aristotle did, an active expansion (*De resp.*, *πνευμάτωσις = σφυγμός*) attributed to some vital endowment (for Erasistratus, and the author of the *Περὶ καρδίης*, and virtually for Galen, muscular) of the vascular walls (*δύναμις*

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[1] All the followers of Athenaeus, so it is said, regard both those movements—both of diastole and of systole—as active.

[2] Krehl indeed opined that diastole was active in a mere physical sense—an elastic recoil. Cf. also Verworn's extension phase of muscular fibre.

σφυγμική (Galen)). "The force that makes them beat (*i.e.* heart and arteries) is, he says, animal or vital spirit or both" *De d. puls.* iv.).[1] The question was: Did the arteries dilate by this virtue in them, or passively because they were filled? I have said that Erasistratus held this latter opinion and regarded the arteries as merely mechanical tubing (*ὀχετοὶ ἄψυχοι*), passively stretched by the pneuma beating within. But probably expansion and contraction, like lightness and heaviness, were generally regarded as entities. Dicroty, as we gather from Rufus and Galen, was regarded as a second weaker beat; an explanation which he accepts, comparing it to the second tap of the hammer on the anvil, the anvil being the inertia (*σκληρότης*) of the arterial wall (*σῶμα*). Rufus described intermittence.

The mechanism of respiration was in Aristotle's doctrine clear enough. The innate heat of the heart, warmed the adjacent lung; the lung expanded (*πνευμάτωσις, ὄγκωσις, De resp.* 20) and with it the thorax; then the incoming draught of air cooled heart and lung, and the thorax subsided. The muscular lift of the chest was not recognised till much later; it was clearly described by Galen. It is remarkable that the earlier physiologists seldom correlated pulse and respiration. Had Aristotle considered the asynchrony of respiration and pulsation, he would have seen that his explanation was void.

The Roman Pneumatists, even of the ability of Archigenes, hampered, as in some degree they were still by the Methodist abstractions of *strictum* and *laxum*, lost sight of some invaluable clinical inferences from qualities of the pulse, which had been perceived by the Alexandrians, and which Galen restored. For instance, these later pneumatists—as we find in Athenaeus, Agathinus, Herodotus, and Archigenes—got entangled in argument between blood content and pneuma content; and between tone (*τόνος*) as pneuma, and tone as a quality of the arterial wall (*κατὰ τὸ σῶμα τῆς ἀρτηρίας*). In such fragments of Archigenes as we possess (Wellmann) we find this confusion between blood content, pneuma content, and arterial wall. And I may note here, a little before due time, that, so far as I know, Galen was the first to point out that the arterial wall is liable to what we call sclerotic degeneration. So, if we try to get behind these confusions, we shall apprehend that the Alexandrians, nurtured in a more scientific school, had, in respect of the circulation, perceived certain most important truths afterwards obscured, and that to these forerunners Galen owed not a little; how much we cannot now tell: he might have owed them more. I may add further this notable instance; that in respect of plethora the difference was then discerned between a long (or sustained) and a short beat, as definitely contrasted with degrees of frequency of beat; and again between the "broad" (*πλατύς*) pulse—as of a relaxed artery with large output, and an ill-filled or contracted pulse. The high pulse (*celer*) of the former case was also described by them; so that they regarded the big pulse (*μέγας*) in three dimensions.

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[1] In a verbose but interesting chapter (Kühn, p. 562) Galen does point out that if the heart be excised it goes on beating, but if a strip of artery be cut out it is motionless. He taught accordingly that with each beat the arteries drew pneuma from the heart (as well as blood). One may wonder also that more was not made by Galen of this illuminating experiment of the excised yet beating heart; the prepossession of innate heat drew a veil over the facts. It has been said that Aristotle likewise had recorded this observation of the excised heart. As I could find no evidence of this I referred the point to Prof. D'Arcy Thompson, who says Aristotle does not mention, nor allude to, the beating of an excised heart. His whole theory of heart-beat is obviously incompatible with any such observation; as *e.g. De resp.* (480 a 1), where he describes the pulsation as caused by the entry of fluid and its subsequent expansion by heat; and goes on to compare the heart with a pair of bellows. (Also *De part.* 703 d 24). Indeed, Prof. Thompson adds: "The phenomena would have seemed to him to be of the highest importance, had he seen it, as proof and verification of his doctrine that the heart is *ἀρχὴ τῆς ζωῆς, ἀρχὴ τῆς φύσεως.*"

The pneumatists considered that in systole air (pneuma) was drawn in, and in diastole the fuliginous excrement expelled; thus they forwarded the scientific conception of diseases as perversions of the normal. It was especially true of Erasistratus, as of Alcmaeon, that he fully grasped this idea, only too soon to be vitiated, that disease is a perversion of health, of the normal processes; not a condition contrary or foreign to biological nature. To take a very interesting example: to those of my readers who are conversant with music the name of Aristoxenus of Tarentum, a pupil of Aristotle, is not unfamiliar, as of one who conceived, or on behalf of his musical tutor recorded, a masterly contribution to the theory of music. Now Aristoxenus flourished in the fourth century just before Herophilus; and it is interesting to find that in his description of the rhythm and arrhythms of the heart Herophilus used the terms of Aristoxenus. For instance, in illustration of the idea of morbid processes as but deviations from the normal, Herophilus distinguished certain cardiac rhythms as characteristic of periods of life. The rhythm of infancy, he said, was a pyrrhic (⏑ ⏑); of adolescence a trochee

(– ⏑); of middle life a spondee (– –); of age an iambus (⏑ –). I am not now concerned to justify these descriptions precisely, but to present them as patterns of method, and of a sound kind of observation, apparently of auscultation. After him Archigenes likewise described and compared taxic and ataxic pulses—gallop rhythms, palpitations ("spasms") of the pulse, and the like—as various degrees of deflexion from the normal towards the abnormal. This fruitful conception of the nature of disease unfortunately became distorted by demonology with its magical cures; and also by the kindred if more spectral hunt of the metaphysicians after "morbid entities," a cry which finds an echo in the words of some eminent physicians even to-day.

SUMMARY.—We may try then to put the ancient story of the heart and its functions into summary as follows. During the period from Alcmaeon to Polybus, the son-in-law of Hippocrates, the blood-vessels were supposed to arise from the brain; although Empedocles had then seen the central importance of the heart as a motor, and supposed it to be the source of the blood (Wellmann, *Frag.* i. 157). The meagre description of the blood-vessels in the Hippocratic books (*e.g.* in *De nat. hom.* and *De nat. ossium*) is said to come from Polybus. Until the heart appeared the embryo was lifeless (*ἄπνουν ζῶον*); it came to life with the respiration, air penetrating into the womb.[1] Even thus the time relations, or priority, of heart and pneuma were left in the vague. Then the *vena cava* monopolised attention; as "the great vessel" its course was traced from the liver to the heart, and thence was continued as the pulmonary artery; the splenic vessels were regarded as some parallel to the portal. Thenceforth unfortunately the abdomen (liver, etc.) came to be regarded as the source and centre not only of the blood but also of its vessels, and indeed was so regarded more or less till Harvey's time.[2] For example, Galen says (*loc. cit.* 547-8): "That some blood may be generated in the heart I do not deny, but that blood which nourishes all the parts of the animal comes not from the heart but from the liver." Albeit during the next or Aristotelian period the heart did for a while gain more and more consideration.[1] Aristotle, who built upon the foundations of Alcmaeon and Diocles (pp. 252 and 257), taught, and was the chief after the Italo-Sicilians to insist, that the heart was the origin and central organ of the circulation—Plato's knot (*ἅμμα*) of the blood-vessels—that the blood-vessels went from it, not through it, and that heart and blood-vessels beat together (*De resp.* 20); that its thicker left ventricle was the seat and protection, not yet of the soul in the Stoic sense, but of the innate heat (even in the embryo before lungs were at work); that the blood arose from it—in the phrase of Diocles *τὸ τῇ καρδίᾳ σύνοικον αἷμα*; and that the access of the pneuma of the heart to the sensorium was established by fine channels, namely by the extension and conversion of the blood-vessels into "nerves" (empty arterioles),[2] and also by channels in the true nerves (Erasistratus). Two vessels, said Aristotle, sprang from the heart, containing different kinds of blood—the vena cava and the aorta. Nowhere does he allude to a purely pneumatic system of vessels (arteries) as imagined by his contemporary Chrysippus, and adopted by Praxagoras and Erasistratus; indeed so far as he failed clearly to distinguish arteries from veins he was behind his forerunners. His admiration of the heart led him to regard it as the seat of vital energy and of the senses, and thus the leader or governor general of the system (*τὸ κυριώτατον* or *ἡγουμένον*; by the Stoics *ἡγεμονικόν*); and this idea of the innate warmth of the heart as a maturing ("concocting") function, second and superior to the visceral coction, survived even to the seventeenth-eighteenth century.

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[1] Aristotle distinguished the two potentials—the heat innate and the pneuma; this for him was less important, derived from the air, and nourished apparently by anathumiasis; but both presided in the heart.

[2] See "Der Bau u. Bedeutung des menschlichen Herzens im klass. Altertum," E. Mühsam, *Janus*, xv., 1910. p. 797; and Noury, "Rôle du foie dans l'antiquité," *Paris Méd.*, 1918, xxviii., Suppl. 240; also Wellmann's *Frag. Samml.*; and Littré, *Hipp.*, *var. loc.* Mühsam's dissertation was suggested by Aschoff. Unhappily his promising pupil died young of a septic wound.

With the lungs the heart was connected by vessels and air-tubes, which in Aristotle's opinion (p. 306) did not anastomose, but lay in such close contiguity that diffusion (?) took place between them (*Hist. an.* i. 78).[3] The blood came originally from the materials in the *primae viae*, absorbed by fine terminals of the vessels in the bowels, "as oil in a lamp by the wick" (Ar. *De resp.*), and being, as he supposed, used up in the organs did not return. It was not propelled, but moved in tides, to and fro "as the sea in the straits of Euripus," determined by irrigation of the tissues; or in obedience to some vibratory quality of its own (Empedocles). This doctrine of the origin of the blood-vessels from the heart Chrysippus carried to Alexandria.

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[1] The *locus classicus* here is Aristotle's *Historia anim.* iii. 21-5. See also *De gen. an.* 743 b 29.

[2] This confusion, and consequent attribution of nerves, faculties of mind, etc., to the heart began with Praxagoras (?) and persisted after Aristotle (666 b 13). Aristotle says (*De part. an.*), *ἔχει δὲ νεύρων πλῆθος ἡ καρδία* ("the heart contains many nerves"—our *chordae tendineae*). Galen, as we have seen, contested this view.

[3] Especial reference must here be made to Prof. D'Arcy Thompson's excellent translation and annotation of this treatise. (Oxford, 1910.) I have referred elsewhere with gratitude to my old friend William Ogle's edition of the *Hist. an.*

Pagel regards the passages cited as the turning-points of anatomical science as regards the heart. I have often referred (p. 315) to the remarkable description of the organ to be found in the treatise, probably Cnidian, *On the Heart* in the Hippocratic Collection (Περὶ καρδίης) which seems pretty clearly to belong to the Aristotelian period.[1] Wellmann surmises that these writers must have had opportunities of dissecting the human heart; but surely there was nothing to be learned from the human which could not equally well be discerned from the porcine heart. We have seen that the author of this treatise recognised the mass of the heart as a vigorous muscle, as did Erasistratus after him, and the relative dimensions of the left ventricle, which was stronger because it had to contend with the powers of heat; and thicker in order to contain it. He fully described, for the first time, the semilunar valves of the aorta and pulmonary artery; as afterwards the mitral and tricuspid were described by Erasistratus. He distinguished also the auricles, ventricles, and pericardium. The auricles were not so much overlooked in those days as regarded, the right especially, as parts of the entering veins; certainly Herophilus included them as parts of the heart; but Harvey first integrated them with the heart by describing their contractile function in relation to the blood-stream. The author of the Περὶ καρδίης regarded them as air (pneuma) bellows. In Greece itself of course anatomy was a hothouse plant; in the Ionian schools the Cnidians were keener anatomists than the Coans, whose great surgical anatomy however is not to be forgotten. The Cnidians seem to have busied themselves chiefly with the organs of generation.

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[1] See Littré, *Hipp.* ix. 80; *ib.* i. 222; and ix. 80, 183. Also Wellmann, *l.c.* p. 94. But it may have been a part of a larger (and post-Aristotelian ?) treatise written by a disciple of Philistion (p. 136), of the Italo-Sicilian school.

Herophilus, concerning the circulation, seems to have made a considerable advance upon his predecessors (see Marx, *loc. cit.*); unfortunately few relics of his writings remain. From Galen, who however was by no means an achromatic medium (see K. viii. 726, etc.), and other sources we gather that, as Praxagoras had done more or less, he clearly distinguished between arteries and veins, pointing out the difference in their coats, those of the arteries being "six times thicker than those of the veins" (Galen ii. 624); these contained blood, those blood and pneuma: and he was not deceived by the equivocal pulmonary artery and veins, for he named the former the artery-like vein, saying it was thicker and bigger than other veins, the latter the vein-like artery (φλὲψ ἀρτηριώδης and ἀρτηρία φλεβώδης). It was Chrysippus and Praxagoras his forerunners, and Erasistratus his colleague, who for many a century emptied the arteries of blood, during life as after death. Thus the left ventricle became the pneumatic chamber, the right the receptacle of the blood; to one school—the Combustion school if I may so name it, the lungs were the means of supply of the fiery element of the air to the blood, and of discharge of fuliginous waste; air was supposed to reach the blood by the trachea (*τραχεῖα ἀρτηρία*) and its bronchial ramifications which interosculated with the finer blood-vessels (Aristotle). Many ancient observers had noticed the difference in colour of the blood after passing the lungs (p. 308), where it was supposed to undergo some process of "coction"; coction being a general term for conversion of phases in animal juices, peptic or pneumatic, a sagacious apprehension of what we mean by metabolism and oxygenation: but the cause of the change, though long regarded as somehow a function of "pneuma," was not recognised before Leonardo (p. 260), and Willis (p. 261).

Again, a good record of the conception then current of the blood-vessels is contained in the typically Coan treatise on the *Sacred Disease* (Περὶ ἱερῆς νούσου) in the Hippocratic Collection, but it is later than Hippocrates, and apparently of Alexandrian origin. About that time the abdominal aorta was rising into notice, as also a "thick vessel" (*παχεῖα ἀρτηρία*). Gradually, by Herophilus definitely, the arteries were attributed more and more to the heart, and the veins to the liver; the arteries being supposed by some writers, too much impressed by their emptiness after death, to serve for the diffusion of the pneuma (*πνεῦμα ζωτικόν*)[1] only.

But it was Aristotle's description, with that of Galen which differed from it in some minor respects, that survived during the Arabian and medieval period; for after Alexandria anatomy—with the important exception of Galen and a few Smyrniotes (p. 156)—fell away, and evaporated in the puerilities of the Middle Ages. The Empirics scoffed at the study as otiose; the Methodists took only a utilitarian view of it; and the Pneumatists did little more than as Galen did after them; namely, insist rightly that arterial blood contained more "pneuma" than venous. The contributions of Galen to the physics of the circulation cannot be clearly estimated, as in his *Dissertation* he mixes up his own opinions with those of Herophilus. (See *e.g.* Gal. *De puls.* viii. 723.) Unfortunately by his assumption of a pervious septum he put everything wrong.

The Modern Story.—Thus from Galen to Harvey the knowledge of the circulation stood still or fell back.[2] Harvey's main difficulty was that he could see no air in the blood, and that he looked upon fire only as a destroyer; he was no chemist and looked upon the chemists of his day with a not unjustifiable contempt. On the causes of innate heat he declined to speculate; though his younger contemporary Borelli, simply by inserting a thermometer into the left ventricle during life, found it no warmer than any other viscus, and thus in a moment shattered the creed of two millenniums. We have seen that ultimately Harvey took Aristotle's doctrine of the hegemony one remove away from the heart and gave it, as did the Hebrews and Empedocles, to the blood;[3] but the heart he regarded physically as a pump. Harvey was the first physiologist to identify the beat of the heart with the systole, as he had occasion to discover during life in the exposed heart of Lord Montgomery. Yet even Corrigan and Stokes were disposed to identify it with the presystolic filling. For Harvey it was the blood that held the innate heat or pneuma, whether brought in congenitally by the semen or otherwise; and he gave it no more heating or elaboration in the heart. This spirit was not a vapour, nor any external agent, but an "internal principle, acting superiorly to the powers of the elements . . . the soul in this spirit and blood being identical with the essence of the stars—celestial in nature."[1] In this nature of it lay its power of causing motion (p. 113). It was left for Boyle—who said that he worked under the influence of Harvey—and for Priestley, to open the next act in the drama.

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[1] See Athenaeus and Galen; also the treatise named, "On Maladies" (*Περὶ νούσων*), Bk. iv. in Hipp. Coll.

[2] I reluctantly pass by the researches on the mechanism of the circulation by that amazing genius Leonardo da Vinci, as outside my subject. See *Arch. d. mal. du cœur*, 1917 (x. 327-331); and Klebs, *Boston Med. and Surg. J.*, July 6 and 13, 1916. The student of his exquisite drawings cannot but think that Leonardo, with his prodigious imagination and mastery of hydraulics, must have discovered the circulation of the blood, but in his manifold and various interests failed to proclaim it. He suggested that the blood might return from the lungs to the heart in expiration.

[3] Cf. also Hipp. *Περὶ νούσων* i. 30 *τὸ αἷμα τὸ ἐν τῷ ἀνθρώπῳ πλεῖστον συμβάλλεται μέρος συνέσιος*

The primary motion of the heart then Harvey derived likewise from an innate principle, the innate heat; indeed he often spoke of heat and motion, and even of soul, as one; though we must remember that he was wont to use words in current rather than in academic senses. The motion of the innate heat or spirits caused the expansion, the diastole—Aristotle's "ebullition or seething"—and the heart's muscle did the retraction; thus still playing the secondary or complementary part. Harvey vaguely attributed the change of colour in the blood, after passing the lungs, to some straining (filtration) in them; there also the fuliginosities were exhaled. The function of the heart in maintaining the systemic blood pressure even Harvey did not conceive; this was left for Hales a hundred years later, with some contribution from Torricelli, to establish on the laws of hydraulics.[2] Nevertheless, as Dr. Crawford has said (Harv. Or., 1919) "Harvey's own quantitative estimates of the output of the ventricle at each systole supplied the single other factor that was needed to compel the conclusion that the same blood was passing time after time through the heart in the course of a circular movement."

As regards *respiration*; to return to the ancient writers: Galen's words in respect of the pneumatic diastole are: "The followers of Erasistratus question how, if the arteries themselves are full of blood, the pneuma can be distributed from the heart to the system. To them we make answer that the pneuma is not sent but drawn (*non mitti sed attrahi*, Lacuna 88. 38), and not from the heart only but from everywhere—the external air, the veins (by their anastomoses with the arteries)," etc. Galen had a glimpse beyond this when he guessed at the ultimate continuity of arteries and veins, because to bleed from any vessel emptied the whole body of blood. Aristotle thought also there must be some such continuity through the flesh. The author of the Περὶ πνεύματος says distinctly that the food for the tissues was poured out through minute terminal openings of the finest vascular twigs. The arteries do not dilate, like bellows, because filled, *e.g.* as Aristotle supposed by a ζέσις τοῦ αἵματος (a fermentation or "coction" of the blood), but fill because of the dilatation, having a sort of energy in their coats (*in tunicis vires* (p. 310)—a very different view from that of the almost inorganic tubes of Erasistratus, p. 311). This dilatation is a universal and simultaneous motion.[1] Galen says distinctly that he had seen the blood in the left ventricle. Respiration and pulsation, which he hypostatised as pulsating energy (δύναμις σφυγμική) he seems to have regarded as one function; although it must be remembered that in his anatomy Galen taught, as Erasistratus had done, that the thorax was expanded and contracted by its muscles; but the lungs were passive sponges. Briefly, as Galen placed the activity of the vegetable or physical (φυσικόν) kind in the pneuma, which he regarded as acquired, not innate, in the second digestion (liver, etc.), where it turned chyme into blood, for him the primary source of the vital spirit was the air, by way of the trachea; but it was separated into the vegetative and animal spirits not in the lungs but in the periphery. In the left ventricle, which it reached through the innumerable pores of the septum, the blood was further purified or matured by the innate heat, in a kind of pepsis, the reek (λιγνύς) being expelled through the pulmonary veins and the expiration, while the indrawn air was mixed with it for the generation, by "pepsis," of the animal pneuma. Galen guessed that in the lungs there were anastomoses between the finest veins and arteries. Thus the blood distributed by the arteries to the body was purer, thinner, and more spirituous. But the content of the pulmonary artery went chiefly for the nutrition of the lungs ; the mitral being in his opinion a two-way valve. Such was the doctrine, a mixture, as also in his theory of fevers, of humoral and pneumatist pathology, the armour of which Galen bequeathed to the following fifteen centuries ; but, save for a few fitful gleams, as in Salerno and the Arabian schools, the ardent spirit, which had animated it, perished with him.

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[1] Cf. Galen, *De usu part.* xvii.: "Mind dwells in the stars better and more perfect than in terrestrial bodies, as their substance is purer."

[2] See Allbutt, Harveian Oration, *Science and Medieval Thought*; and J. G. Curtis, *Harvey's Views on the Circulation, etc.* New York, 1915.

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[1] See *De nat. fac.* iii.; *De motu musc.* i.; *De usu part.* vii.; *De pulsuum usu*, etc.

Of the *mechanics* of respiration I have said little ; the opinions of the ancients, or indeed of all physiologists from Hippocrates to Haller, on this subject are not very interesting ; except by the way the study by Galen of the muscular movements of the walls of the thorax ; in itself a good observation, but it was not correlated with the pulmonary tides. Herophilus described in respiration four acts : the indraught of air, its distribution, its regathering, and its expulsion. The costal mechanism seems not to have been imperfectly perceived, and the laws of air pressure were of course still farther away in obscurity.

CHAPTER XIV

DOCTRINES OF GENERATION

After the pulse lore of these schools, I would make some reference to their doctrines on *sexual generation* ; for herein also we revere the memory of our immortal Harvey. And when, in comparing his results in this field with those on the physiology of the circulation, we dare to reflect that, as even supreme genius cannot penetrate far beyond the limits of contemporary means of research, we cast no shadow on that great memory. The problem of generation, as it presented itself to the ancients, is too difficult to put succinctly without a renunciation of much of its detail and of the history of many tides of opinion. Our sources in this respect are however very scanty, and depend in great part upon what is recorded in Galen's Περὶ σπέρματος (iv. 593).

Concerning the respective virtues of male and female in the generation and development of the embryo, the opinion of Hippocrates is clear—that the ovaries corresponded to the testes, and that male and female both contributed seed. Empedocles and Diocles likewise held this same long-prevalent opinion (Diels, *Doxog*. 290). The semen, they thought, came from the brain and spinal marrow, and that excessive copulation injured the senses and the spine, a notion handed on to Plato. Diogenes of Apollonia derived the semen from the food by way of the blood (*sperma sanguinis*). For the investigation of some sexual problems Diocles dissected mules. Again, the Sicilian school, followed later by Diocles, taught also that boys developed in the womb quicker than girls, because they occupied the warmer (right) side of the womb. Even the superb anatomy of Vesalius left these physiological notions unaltered until the seventeenth century, when they were undermined by the labour of Highmore, Stenson, and de Graaf. From Hippocrates we come to the opinions of Aristotle which are too well known to need a careful description here. Suffice it to say that this great sage firmly and consistently denied that the female contributed seed ; the semen, the finest concoction of the male blood, as a dynamic element (*τὸ ἄρρεν ποιητικόν*) quickened the passive but plastic female element (*τὸ θῆλυ παθητικόν*),[1] enduing it with "form." He saw no difficulty in the resemblance to the mother ; for did not plants vary with the soils in which they might be planted ? He admitted however that in the catamenia the female contributed some kind of generative substance (*γονή*) but, contrasting it with *σπέρμα*, held that it was but of a rudimentary kind. As to the preparation of semen as a perfected product of the blood, in this respect Aristotle seems to have followed Democritus, Hippocrates, and Praxagoras in a speculation which reminds us of Darwin's idea of pangenesis. His objection against the seminal contribution of the female—that she could be impregnated without orgasm, and even unconsciously—was less adequate. Often are we tempted to think how happily we could have jogged the elbow of a great scientific father and supplied him with just the notion he needed ; for Aristotle had a good knowledge of the egg ; and how well the human ovum would have fulfilled his argument[2] Fabricius and Harvey perceived and von Baer finally proved. Chrysippus placed only a vegetative pneuma in the embryo. Straton, so far as we can tell, seems not to have followed Aristotle's footsteps closely ; he dwelt more, as did some other authors, on prepotency, and assumed that in particular cases the prepotency might lie with either male or female.

Next we come to Alexandria and to Herophilus, who described the ovaries (*δίδυμοι*), and the tubes (*σπερματικοὶ πόροι*); but this more accurate anatomy did not reveal more physiology. So far as it went indeed it seemed in favour of seed in both sexes; but the Aristotelians, magnifying the content of the *σπέρμα*, fancied that these female parts were but a "structural harmony," after the kind of the male mamma. It is notable that Fallopius, himself a master in this field of anatomy, and pursuing the same positive methods as Herophilus, scrutinised the ovaries and vesicles minutely in search of a seminal element, and, finding none, denied seed to the female. And we may suppose that Harvey, in holding the same opinion and denying that the ovaries, to which he attributed a rather fantastic function, were an equivalent of the testes, followed Fallopius. Erasistratus seems to have made little research in this field. Of the pneumatists Athenaeus, and Archigenes who followed him, seem to have been the last physicians of the period to rely upon Aristotle; they denied seed to the female, and Athenaeus seems to me to be even more positive about it than Aristotle himself. Galen definitely attributed dynamic seed to both female and male. In the pneumatico-stoic opinion the semen was sublimated from the hegemonic spirit in the heart. For Galen, the old demur that the progeny were as prone to resemble the mother as the father, held no difficulty; he assumed that each sex afforded a seed endowed not only with virtue but also with substance (*δύναμις* and *ὕλη*); yet he betrays a curious uneasiness about it, for how is it, he candidly asks himself, that the female never conceives alone?

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[1] It is usually supposed that Aristotle took the *σπέρμα* to imply the body of the foetus ; he seems to have given too much content to the *σπέρμα*, but "form" is far from merely signifying structure. As we gather from the *Eumenides*, concerning the appeal for the acquittal of Orestes, the idea of deposit of the embryo by the male to be nourished by the female, as in a nest, was far older than Aristotle, and contains far more than "form." But we must remember that in early times the differentiation of notions to which we are accustomed had not been accomplished.

[2] See the eighteenth chapter of the *De generatione animalium* ; and also the *De anima*. After these lines were written I read in the *British Medical Journal* (August 13, 1910) an able and interesting article, signed "J. W. B.," on Dante's knowledge of Aristotle's *De generatione*, and noted that in Dante's words we might observe a strong infusion of the pneumatic doctrine. I venture however, with great respect, to question if Dante's account of the accretion or supervention of the animal upon the plant soul can be interpreted as a "flash of insight" into our modern idea of the embryo "climbing up its own genealogical tree." His phrases seem to me to contain no more than we meet with not infrequently in ancient and medieval speculation.

CHAPTER XV

HYGIENE AND THERAPEUTICS

The hygienic and therapeutical doctrines of the pneumatists, and of the eclectic or "episynthetic" physicians who assimilated the more effective results of methodist, empirical, and other schools of the period, were of considerable interest and importance. The hygiene of the period is of peculiar interest to us, who at this moment are occupied with the medical aspect of education, that we may note the close attention this branch of the public service had received from the Greek physicians in Rome. Celsus, from the point of view of a Roman gentleman, gave some excellent hints on this subject (p. 209). Of Athenaeus the following interesting fragment is preserved in Oribasius iii. 164: *χρήσιμον δὲ ἢ μᾶλλον ἀναγκαῖον πᾶσιν ἀνθρώποις ἀπὸ ταύτης τῆς ἡλικίας ἅμα τοῖς ἄλλοις μαθήμασι συμπαραλαμβάνειν καὶ τὴν ἰατρικήν, καὶ κατακούειν τὸν ταύτης λόγον, ἵνα καλοὶ καὶ ἀγαθοὶ σύμβουλοι γένωνται πολλάκις ἑαυτοῖς τῶν εἰς σωτηρίαν χρησίμων* ("It is desirable, or indeed essential, that every man from his youth up, should include medicine in his studies . . . that he may become a wise counsellor in all that concerns public safety"). For Athenaeus indeed medicine was even more than this, it was an integral part of a liberal education.[1] Galen divided medicine into two equivalent parts—the remedial and the hygienic.

On airs—as of day and night, and of hills and valleys, on lunar and solar seasons, and on climates—the pneumatists, as we should anticipate, laid great stress. Accordingly we find such airs described as moist or dry, hot or cold, dense or thin. Night air was cold and thick, and consequently apt to cause rheumatism, fever, and inflammation. I need not stay to interpret by modern researches the warning that of seasons the air of autumn was the most dangerous; and that during these months one should never sleep out of doors. The air of towns was warm and thick, so that natives of towns grew fat, and were sluggish in their secretions. The air of enclosed valleys was bad; so likewise the air of river flats and of marshy places. Inland air was said to be more wholesome than that of the seaside, an opinion derived perhaps from the malarious infection of estuaries, and of harbours such as Ostia.

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[1] See Söllner, *Jenaer med.-hist. Beiträge* on the hygiene of Vitruvius.

Drinking water was to be filtered through porous stone or earth, but particularly to remove dirt and leeches.

From the fifth century B.C. onwards much attention had been given to the qualities of drinking waters. The treatise of Hippocrates on *Airs, Waters, and Places* was, as we know, epoch-making in the establishment of therapeutics by way of this and other external conditions. The Hippocratic writers classified waters by their saline constituents and their temperature. Aristotle attributed heat in mineral waters to subterranean fires and pneuma (radium!) therewith; the salts to the sea or the earth through which the waters pass. Stagnant waters were refused and spring water from hills or rain water approved.[1] Even in those days we may trace also that prejudice against snow and ice water still so firmly rooted in the mind of the Swiss guide. Freezing was supposed to expel the finest essences of the water. On the hygienic use of baths by Greeks and Romans we are well informed. The water supply of our largest cities is now, per head, about one-tenth of the supply of ancient Rome. We know that Thermae existed during the Republic; but Asclepiades was the first medical author to write practically on the use of baths in health and disease. Massage and unguents were systematically made use of. The hot waters and sulphur springs of volcanic districts were prescribed for certain maladies. For a full account of Spa treatment I must refer you to Marquardt; and to such special works as Vetter's *Hdbh. d. Heilquellenlehre.* Another remarkable practice of disinfection was that of the hall after the slaughter of the suitors (in the last book of the *Odyssey*) by means of the fumes of sulphur. Mr. W. H. S. Jones thinks this practice may have been a northern custom brought by the Achaeans. The hygiene of the Greek armies, if we may judge from Xenophon,

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[1] As by the Peripatetic school, and by Vitruvius, Pliny, Athenaeus, etc.

Plutarch, and other witnesses, was anxiously provided for, and the number of army doctors many; it is said that the Greek provision was one doctor per 1000 men.[1] The Greeks moreover carefully studied the hygienic as well as the other aspects of the education of children, and carried their doctrines forward into Rome. The integration of hygienic methods in the nurture and mutual animation of body and mind was but one part of the insight of this wonderful people which in later centuries was blotted out; yet even to the later Greeks many rules of hygiene, to us obvious, seem to have been unknown: *e.g.* Herodotus notes as strange that the Persian king *boiled* his drinking water.[2]

Diels draws attention to the careful adaptation of hygienic rules to the periods of the individual life. Still depending chiefly upon the reports of Oribasius and Aetius which, as regards Athenaeus, Agathinus, and Herodotus,[3] are fortunately copious, we find that the pneumatists regarded its course as of four stages —of infancy, of adolescence, of middle age, and of old age. We shall note with particular interest that they discouraged all serious school work before the age of six or seven; then the child was to be taken in hand by a mild and kindly master, who would discipline the child by changes of work and play, carefully avoiding prolonged stress of either, but encouraging him by emulation, finding for him a delight in learning, and remembering that severity or satiety engenders an aversion which in after-life may never be overcome. From the age of twelve however the work was made tougher; the pupil was led to feel his powers and to put them forth in such studies as grammar. The master was to be well versed not only in intellectual matters but also in dietetics, in the wide range of exercises known as gymnastic, in the use of the bath, and particularly in the apportionment of the hours of sleep. Thus, as the boy grew up, bodily and mental development went hand in hand; and in adolescence, in order that every man should understand the conditions and promotions of a normal life, medicine and philosophy were introduced into the curriculum. Concupiscence was subdued in youth by gymnastics, and by the general discipline of mind and body. In maturity the generative function was approached with due sense of responsibility, and directions were given for the *παρασκευὴ πρὸς τὴ παιδοποιίαν* ("the preparation for procreation"). The sage council was given not to forget even in youth the prospect of old age, and, as years wore on, to economise the efforts of body and mind, and to cut down the quantities of food; at all ages the food was to be reduced in warm weather. And, with the exquisite Greek sense of balance even in physiology, and of the unity of bodily and spiritual function, they reminded us—for are not these lessons for all time?—that in a healthy old age we should seek to be wholesome not only in body, but gentle of soul also; high-minded, never tiresome, in sympathy and fellowship lifting up the young with the fullness of sweet lessons from the past. In the education of women, while a wholesome interest in political affairs was not denied to them, they were advised to concentrate themselves upon the arts of the home and family. Such, when divested of their necessarily crude biological hypotheses, was the ripe wisdom and sagacity of these great physicians, so far away and yet so near to us.

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[1] See Linacre Lecture in this volume (p. 466).

[2] This reference I owe to Mr. W. H. S. Jones.

[3] As, for instance, Orib. iii. 107 ἐκ τοῦ Ἀθηναίου. For certain comments upon these passages I am indebted again to Wellmann (*loc. cit.*).

Therapeutics.—The remedial therapeutics of the Roman physicians between Celsus and Galen have not, in their fuller details at any rate, the same practical interest for us as their hygienic teaching. We may glance somewhat cursorily at a few of the means. In their eclectic and expectant methods, in the development of physical means of cure, and in some use of wine, we note that influence of Hippocrates, Erasistratus, and Asclepiades upon the pneumatico-eclectic schools to which I have repeatedly invited your attention; but it is with less satisfaction that we note again the influence of the Herophileans in that increasing use of drugs, and of violent means such as emetics, clysters, purgatives, and venesection, which gave a certain grossness to the therapeutics of Galen himself, and under his influence degraded medicine more and more till the days of Molière. Herophilus and his school revered Hippocrates in lip-service, and, indeed, did much to preserve and elucidate his writings; but their disciples never obeyed the spirit of his therapeutics which were founded upon prognosis and upon respect for the endowments of Nature. It seems not to be generally known that Hippocrates and his followers not only used physical therapeutics but also, for prognosis in which they excelled, they tested their patients by degrees of effort in artificial exercises, as we are learning to do to-day.

Asclepiades had, as we remember, carried physical therapeutics to lengths almost, or quite, absurd; as in his swings, jolts, and successions. Therapeutical *gymnastics* had been admirably developed from the Hippocratean schools through Diocles and Praxagoras of Cos. The earliest of these professors known to us was Herodicus of Selymbria in Thrace, said to have been the master of Hippocrates; he belonged no doubt to the ranks of fully accomplished physicians. But it is also to be observed that not only by Asclepiades and Celsus but also before them, indeed from Hippocratean times, and more especially in the Coan than in the Cnidian School, the intemperate pursuit or profession of gymnastics was deprecated, not only as injurious to the health, but also as illiberal (*κακοτεχνία*, Galen). Moreover out of these services arose a large class of quasi-medical *iatroleiptes* (anointers after the bath) who brought their craft into much disrepute. Thus arose among the more sagacious physicians a continual mistrust of the more pretentious gymnastic schools.[1]

At present however I will speak only of the passive movements, of the *massage* of the period, which seems to have been elaborate and refined. The entire body seems, often at any rate, to have been massaged at once by four or six performers; two performers manipulated the arms, hands and fingers, two the trunk, two the legs and feet. The first stages were slow and gentle, the later became gradually quicker and severer. We may note with interest that gentle massage was practised in fevers, so long as there was no acute focal lesion; the tolerance of the patient of its degrees and durations being carefully watched. The amelioration, which by this means they professed to obtain, was attributed in part to refrigeration by the induction of sweat. This practice may not be unworthy of our own consideration. The fever lore of these ancients was, as we all know, enormous; as Wellmann says, and as Mr. W. S. H. Jones has more exhaustively proved, it was a literature in itself.

And we are all well aware also that in therapeutics the *cult*

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[1] On this subject the reader is referred to the admirable study by Juthner of Philostratos *Über Gymnastik*, Leipzig, 1909. (Philostratus lived soon after Galen.) See also J. E. Chrysaphis, Ἡ Ἑλληνικὴ *δισκοβολία* (in modern greek, but also in french translation, 1906). And in the second Book Αἱ *περὶ γυμναστικῆς δοξασίαι τοῦ Γαλήνου*, Athens, 1910, is contained a historical study of gymnastic.

of water springs and the *bath literature* of early times, before as well as after Epidaurus, was no less prodigious.[1] The Alexandrian Greeks owed but little to the Pharaonic Egyptians, who gave however, as we gather from Herodotus (i. 193, 198, and ii. 35-37), some consideration to hygiene. They had a State health service, and practised many ablutions of person and clothing, as did the Babylonians also. The honour of filth in person, clothing, and condition was left for medieval times. The Egyptians also vigilantly and ceremoniously protected their water-courses. I have alluded to the Persian king who boiled his drinking water.

The ancient magic of wells, which developed into the Epidaurian combination of theurgic and therapeutic ritual, had in the times of which we are speaking become a separate resource. The Roman physicians seem to have ignored the Tiber Island. But we read of pure water baths, of saline baths (" which warmed the body "), of oil baths for cramps, pains, and retention of urine, of sand baths, and of sun baths.[1] The Asclepieion at Athens was built about a saline spring which rose in fountains on its terrace and was used in the cure. Asclepiades, and after him the pneumatists, argued against the abuse of warm baths which, however appropriate in their degrees for debilitated persons, were not bracing enough in fevers, nor even for use in health. Here we recall Musa's reputed cold-water cure of his august patient (p. 212). Nurses were lectured for " boiling their children " ; and bathers were warned against letting water into the ears, " which damages them." Mineral waters, of course, had their many natural virtues. Archigenes gives us the first extant rational classification of mineral waters ; he divided them into the alkaline (soda), saline, aluminous, sulphurous, ferrous, cuprous, and bituminous ; and elaborately explains their effects by the humoral hypothesis.

Wine.—The place of wine as a remedy is a curious story ; in my *Harveian Oration* (1900) I touched upon it, but especially as regards its outward application, even from the days of Machaon and the Good Samaritan. Hippocrates says (Περὶ ἑλκῶν c. i.) wounds as a rule should not be moistened save with wine. Galen taught that no application for wounds was better than wine.[2]

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[1] The reader who desires to know more of this history may be referred to the Second Book of Oribasius, chiefly compiled from the works of the distinguished pneumatist physician Herodotus, pupil of Agathinus.

[2] Θεραπευτικὴ μέθοδος Kühn, vol. x. cap. 5-6. See my *Hist. Relations of Med. and Surgery*, London, 1905.

The use and disuse of wine, as of bleeding, the diet of figs and other particular vegetables, of salt fish, of shell fish, and so on, are among those strands of tradition which help us to trace doctrine and tradition from school to school. There were teetotal doctors, and wine-bibbing doctors. Menecrates of Tralles was called *φυσικὸς οἰνοδότης*. Asclepiades wrote an essay *Περὶ οἴνου δόσεως*, an epoch-making work in its way, the contents of which may be gathered from Pliny (*N.H.* xxiii. 31), and Dioscorides (v. 7), amid paragraphs deriving from such recipe complications as that of Sextius Niger. As I stated in a former lecture, Asclepiades, who also was nicknamed *οἰνοδότης*, taught the therapeutical value of wine (p. 154), and discussed the virtues of its various kinds—the Greek, the Roman, and so on; but the advocacy of Athenaeus seems, from negative evidence, as from the lack of certain details in Pliny and Dioscorides, to have been inspired not directly by or from Asclepiades but by the tradition of Diocles, Praxagoras, and Mnesitheos, authors to whom those compilers do not allude. Athenaeus says that wine when carefully used—used with attention to proper rules of symptoms, of doses, of dilutions, of hours—arouses the pneuma from its torpor; and, as Archigenes repeated afterwards, is especially useful in syncope. Now syncope was then said to consist in a loss of tone (*τόνος*), a vital quality to which the pneumatists attached much importance, and the state of which for the whole body they were wont to infer from the tone of the pulse. If under its use the acceleration of the pulse persisted, in fever for instance, they inferred that the remedy should be withdrawn. Allusions to the several kinds of wine give occasional help in fixing dates and in tracing sources. At the beginning of the third century B.C. Roman wines were unknown to Greeks who after that date became gradually familiar with their varieties. It is worth noting that Aretaeus the Cappadocian (p. 277) who seems not to have visited Rome, yet recommends Italian wines —Falernian, Surrentine, Fundan, and so on. Bruns gives the following diagram of the wine tradition:—[1]

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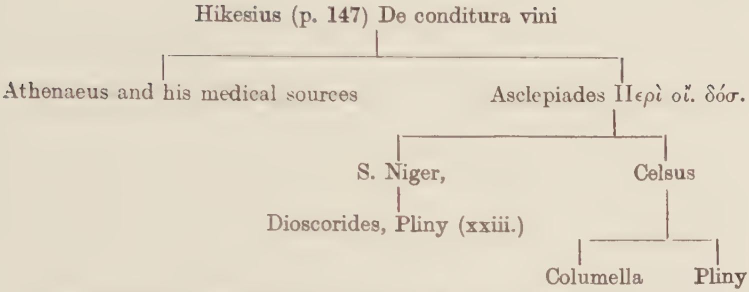
[1] Wellmann, *Hermes*, xxxiii., 1900.


Hikesius (p. 147) De conditura vini
Athenaeus and his medical sources
Asclepiades Περὶ οἴ. δόσ.
S. Niger,
Dioscorides, Pliny (xxiii.)
Celsus
Columella
Pliny

Venesection.—But I need not say that of all the therapeutical means practised and discussed in those days the most ascendant was venesection; and concerning it the controversies of the schools were the most stubborn and acrimonious. Diocles approved of venesection except in weakly persons. In a former lecture I noted the reserve of Asclepiades in respect of venesection; a means which, for good reasons, he did not altogether withhold, but kept in hand for critical moments. The close attention of Athenaeus and the pneumatist school to the pulse gave no little importance to their teaching concerning this remedy, but the protest against the practice of venesection as a mighty and a vulgar ally against disease in general carries us back into a much dimmer past. Not to detain you by a long retrospect on the sacredness of the blood—no unfamiliar subject in the Old Testament for instance—I may briefly remind you of this superstition in the semi-Oriental mysticism of Pythagoras; and so onward in medicine it influenced Empedocles and the Sicilian School, Philistion of Locroi—who influenced the Cnidians, and challenged Chrysippus. If we may rely upon certain passages in the eleventh volume of Galen, *De ven. sect. adv. Erasistr.* (c. 2, pp. 150, 197 and 252), Chrysippus stood prominently forth as an opponent of bleeding (p. 138), and his deprecation was heeded more especially, so it was said, by Straton, by one Medius an uncle of Erasistratus, and then, as we know, by Erasistratus himself and his disciples. Galen, who called Erasistratus a haemophobist, regarded this refusal as insane. He said that as Erasistratus was ignorant of innate heat he could not comprehend the conditions of the problem. This forbearance was a little more remarkable in that the Erasistrateans, and indeed Chrysippus himself, clearly perceived the perils of plethora, which they attributed to absorption of ill-digested food (Anon. Lond.), and regarded as the cause of many diseases, but combated by diet (pp. 153-4). The objection to bleeding was formulated as giving an opening for the escape of the animal spirit (πνεῦμα ζωτικόν). Apollonius, a pneumatist of whom we know little, although indisposed to bleeding as a routine, contributed the interesting demur, that in plethora the permeation of the periphery by the πνεῦμα φυσικόν (the animal spirit) was retarded. As reasonable persons therefore they accepted no formula, but, before using the remedy, estimated the general conditions of the malady, the state of the patient as to strength and nutrition, and so forth; especially as to age and sex. Archigenes advised that in plethora bleeding in some form was not inappropriate; and many of the school believed at least that by this means foul humours could be evacuated. In fevers however most physicians perceived that to reduce diet, and at the same time to draw blood, was to exhaust the patient;[1] therefore, to prevent the inflammatory indraught of blood into the arteries in fever, the master, after the Alexandrian tradition, bandaged the proximal parts of the patient's limbs (p. 332), so that by keeping the synastomoses closed the conflagration of blood and pneuma in the thorax might be prevented, and the nutrient blood retained in these limbs, which waste in fever, especially under the low diet which Chrysippus prescribed in fevers. We have seen that Erasistratus (p. 306), to account for blood in the arteries, assumed certain more or less distal communications between the veins and the arteries, gates normally guarded or closed. Furthermore, Herophilus anticipated a modern practice of bandaging the limbs in or against haemorrhage; and Erasistratus carried it farther by bandaging also the trunk of the body. The Methodists used venesection only in severe dyspnoea, haemoptysis, and the acuter pneumonias and anginas. On account of their meticulous shunning of venesection, though they limited rather than repudiated it, Galen waxed almost as hot against the Pneumatists as against the Methodists; but Celsus (lii. 3), who in this respect was an Erasistratean, in his cool and shrewd way had said long before, in reference to Asclepiades, "*Sanguinem incisa vena mitti novum non est, sed nullum paene morbum esse in quo non mittatur, novum est.*" The pneumatists, or Erasistrateans, reasonably argued that in many cases local ought to be preferred to general bleeding, as by cupping, scarification, or leeches ; that indeed in not a few cases even dry cupping or a cataplasm would suffice to draw off a congestion.

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[1] In more than one passage of Galen's XIth Book. See also Bk. x. 376.

I will not waste your time on the story of the controversies on the respective sides—right and left—in venesection, a controversy into which Galen and the medievalists were drawn. The issue was unsubstantial and the arguments were futile. I have said that Hippocrates began it (*Prorrhetics* i. 125, Littré v. 554) by contrasting epistaxis from the nostril of this side or of that in enlarged spleen ; if the nose bled on the opposite side the omen was unfavourable. Then came the visionary hypotheses of derivation and revulsion by which the side of a venesection was to be determined. The dependence of bleeding on the phases of the sun and moon was a commonplace in Rome (*e.g.* Galen, *Reg. in ac. dis.*). Furthermore, which vein to open in a particular case or malady, in the elbow, in the ankle, in the temple, at the nasal angle, in the tongue, in the little or ring finger ; and then again on which side of the body, in the times of which we are speaking, and still more in the Middle Ages, was a problem often decided on fantastic reasons.

Arteriotomy was practised occasionally by the ancients, but under what conditions is not precisely known.

CHAPTER XVI

ON CERTAIN DISEASES; ESPECIALLY INFECTIONS

To attempt to identify the inner diseases of the Roman period and realm would be a tedious and hardly remunerative task. Many of those prevalent now as then may be clear to us; but when we try to reconstruct other morbid series we find extant descriptions too fragmentary, allusive, indefinite, or confused for full recognition. In surgery, the subjects of which are more definite, the task is not so thankless (p. 344), and has been well done by Gurlt, especially for ancient times, and by others. Nevertheless I may venture upon a few incidental remarks on the infectious diseases of Rome, so far as known to us; diseases which from time to time harried or devastated Rome; for these misfortunes had no little effect upon her history.

The first of them, that to which the minds of my hearers will turn at once, is *Malaria*; not merely for its medical importance but also for its remarkable bearings upon history.

The curious historical inquiries concerning Malaria in the Aegean, especially in Magna Graecia and Rome, inquiries which have arisen on the recent discovery of the nature and propagation of the disease, are too well known to need repetition in this place. It is now recognised, thanks to the researches of Mr. W. H. S. Jones, that malaria may be one, and not the least, of the causes of the desolation of the great cities of South Italy, such as Tarentum, Metapontum, Sybaris, Capua—a sudden and final desolation not easy otherwise to account for; and of degrees and periods of decadence in other cities which, more or less in adversity, survived. Dr. Genovese of Reggio, quoted by Mr. Jones, from local knowledge arrived independently at the same conclusions. He concluded that in Magna Graecia in early times there was no malaria. Sybaris for example, being seated "not on a height but in a dangerous hollow," could scarcely have arisen and grown under the scourge of malaria, or on its epidemic invasion have successfully resisted it. Rome, we know, was grievously scourged by pestilences of one kind or another. Mr. Jones concludes that malaria, the most relentless of all infections, was of comparatively late introduction into Middle Italy, directly perhaps from South Italy, probably from Greece, or Egypt an ancient seat of the disease. It was in Sicily and the peninsula by 500 B.C., but in those days would travel slowly. In his tract *Dea Febris*—a very ancient cult—(Liverpool University Press, 1909), after a close analysis of the records of fever in Rome, Mr. Jones concludes that malaria did not establish itself *in Latium* until about 400 B.C. Greece may have been free from malaria before the fifth century; but, as Mr. Auden has pointed out (*Nature*, Jan. 6, 1910), Sophocles, in the *Philoctetes*, gives an unmistakable description of an attack; perhaps because the malady was then of recent introduction. In Aristotle's time Greece had become highly and widely malarious. If we may judge by the settlements of the Etruscans, a very intelligent and vigorous folk, settlements in later times uninhabitable on account of malaria, we may suppose that at the time of their arrival Central Italy had not become infected. Ravenna in the time of Strabo was still healthy.[1] A pestilence which broke out in Italy in 208 B.C., during the Hannibalic War, Mr. Jones regards "as almost certainly malarial" (Livy xxvii. 23). Unmistakable allusions to malaria occur in Latin literature from Cato and Plautus onwards. By the end of the Republic all marshy areas of Middle and South Italy and Sardinia had become infected, and Rome itself was suffering; though the towns suffered less than the rural districts. The devastation of war, the vast importations and largesses of corn, and the consequent overgrowth of *latifundia*—very large farms ill cultivated by serf labour—were both favouring and consequential conditions; a vicious circle. If malaria were not the chief cause of the slow degradation of the Empire itself, no doubt it aided the course of events; for instance by the high death-rate of children, by shifting from large infected areas of the richer and more energetic population, and by decline of health, spirits, and *moral* among those that remained. The indolence and indisposition caused by malaria, and the low survival-rate of children, would increase the unhappy seduction of the later Romans to rely upon colonial and even foreign troops for their armies. In the course of centuries some changes in the distribution of malaria have taken place as, from changes of conditions, we might have expected. I need not say that Ravenna is now highly malarious; and other places also, now malarious, seem in early times to have been immune. Columella (i. 1) makes the remarkable statement that in the past Italy had been so cold that the vine and olive would not bear; but that later a warmer period had set in.[1]

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[1] See Strabo, bk. v., Tozer's excellent *Selections*, p. 142, where the author insists on its remarkable healthiness as contrasted with some other places on a river delta (*ἔστι μὲν οὖν καὶ τοῦτο θαυμαστὸν . . . τοὺς ἀέρας ἀβλαβεῖς εἶναι κτλ.* Ravenna was satirised (see Tozer's note) for brackish drinking water and wet subsoil, so that "sitiunt vivi, natant sepulti" (they live in thirst and are drowned in their tombs) (Sid. Apoll.).

As trade extended we can readily understand how time after time the infection was carried, from Greece or Egypt for example where malaria was well known in early (Hippocratic) times (see Περὶ ἀέρων i. 566-7), and, by enlarged spleens, haggard children, and a sluggish, anaemic, "bilious" people, stamped its characters upon the race; the same facts I remember well as an undergraduate in Cambridge. Now for two generations this district has been free. In the fifth century B.C. a beautiful coin, struck by the city of Selinus in Sicily in honour of Empedocles, records how he stopped an endemic of fever by draining a certain marsh. Diodorus Siculus, in his story of the Syracusan War, says that before the defeat of Nicias at sea a pestilence broke out in the Athenian camp, which was pitched on or around the swampy harbour.

That in the first half of the second century B.C., in the country districts, Cato had to deal with malaria, is witnessed by his note on black bile and swollen spleen (*De re rust.* c. 157); and about the same date we read in Terence of the *febris cotidiana*, and *f. quartana*. In a fragment of Lucilius a shivering fever is mentioned. Moreover in Hippocratean times we note that fevers were marked by periodicity. I have before suggested that *Causus* was the aestivo-autumnal form, often unattended with rigors. Yet in Cicero's day Rome itself seems still to have been comparatively free from malaria; for Cicero was ready to remain in Rome during the autumn, saying that many districts elsewhere, such as Sardinia, Brundusium, and even Baiae, were far more pestilential; as in modern times towns suffer less than country so was it then. A generation later, as the latifundia were extended, malarious fevers grew worse. In the second century B.C. Asclepiades (Cael. Aurel. *De m. ac.* ii. 10; quoted Jones) says "apud Romam vero frequentare advertimus has febres." Varro (201–116 B.C.) warns against throwing money away upon pestilential lands in these remarkable words: for "tiny, even invisible, animals are bred in marshes which enter by the mouth and nostrils" (i. 12). Columella, who lived about our era, expresses a like opinion in words still more remarkable. He says: "Nor, indeed, must there be a marsh near the buildings, nor adjoining a public highway; for a marsh always throws up noxious and poisonous steams during the heats, and breeds animals armed with mischievous stings, which fly upon us in exceeding thick swarms; as it also sends forth, from the mud and fermented dirt, envenomed pests of water-snakes and serpents, deprived of the moisture they enjoyed in winter; whereby hidden diseases are often contracted, the causes of which even the physicians themselves cannot thoroughly understand"[1]; a touching confidence in medical insight. Pliny makes at least forty references to malaria, Celsus bears abundant testimony to the same effect, and Tacitus speaks of the Vatican district as thus pestilential.[2] Under the later Republic and the Empire then malaria was familiar, widespread, and often pernicious.[3] Some of the more definite allusions to malaria are in respect of remedies, such as pepper (p. 26) in Dioscorides, in Pliny, and in recipe collections like that of Aemilius Macer.[4] Sir R. Ross told Mr. Jones that pepper was really of some service in the more distressing phases of ague. Celsus however does not mention it. Port wine and laudanum were the antidotes preferred by our English fenland farmers; and the richer of them were careful not to neglect the more genial drug.

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[1] See again W. H. S. Jones, *Dea Febris.* Genovese also is of opinion that the Italian climate had become warmer than in early times.

As regards the peninsula as a whole then the invasion must have been in gradual periods, broken occasionally by more virulent outbreaks. I need not tarry to explain the elements of chance in the carriage of the microbe; how when the battledores are few the shuttlecocks fall again and again, and the invasion ceases until, as trade develops, more and more human carriers are established, especially among the children. Thus fitful probably was the invasion of Magna Graecia during the days of its prime. The proper fly was probably in readiness long before the microbe arrived, though I should add that some authors think the variable coefficient may have been the Anopheles.

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[1] Columella (*De re rustica*, Book i. chap. v.).

[2] See W. H. S. Jones, *Malaria*, c. iii.

[3] See Hor. *Ep.* i.; Martial, Seneca *var. loc.*, and many other testimonies.

[4] Quodque movere solet frigus periodica febris
Compescit, febris si sumitur ante tremorem.
(AEM. M. *De pipere*).

In a paper presented to the Royal Geographical Society in 1910 Mr. E. Huntingdon discussed the determining causes of malaria in the several Mediterranean regions, such as deforestation, drainage and so forth, and produced strong reasons to believe with Columella that one main cause at any rate lay in a secular change of climate during a period of, say, 2000 years, with subordinate but rather large fluctuations. His argument cannot here be given at length; he thinks that, had ancient Greece and South Italy been as fit a habitat for the Anopheles as in later times, the continual intercourse of the peoples must have spread the disease widely abroad. For the mode and effects of such changes of climate I must refer the reader to Mr. Huntingdon's essay. We have to remember of course that for the spread of malaria the number of infected persons must rise in some definite proportion to the number of Anopheles. Intercourse of peoples is free enough in England, and we have Anopheles not a few, but hitherto there has been no recrudescence of the malaria; rife as in my young days it was in Cambridgeshire.

Travellers and residents and the military medical officers who have served at Salonica and elsewhere in the Mediterranean countries tell us that the number and variety of fevers there prevalent are many and often baffle diagnosis. Aristotle says in the *Problems*[1] that, as distinguished from plague and consumption, πυρετοί are not infectious. There were then many fevers not (apparently) infectious. If we at this day often fail to differentiate these maladies, we cannot hope to discern them through the hearsay of the ancients. How large a place amid these πυρετοί was taken by diseases of the typhoidal or coliform enteric kind, or again by Malta fever, if any place at all, seems indeterminable. The words of Celsus make no clear point to them. Remittency seems to have been a marked feature of Mediterranean πυρετοί; with us the typhoids are remittent in children. We shall not forget that even in our own day the diagnosis of typhoid in India was long contested and undecided, and depended much upon laboratory methods. No doubt phases of disease vary with varying conditions. Broadly speaking, fevers were said to have the four phases of Onset, Increase, Maturity (Coction), Decline (Elimination). Fevers due to sepsis of the humours, and so distinguished from the Hectic, were attributed rather to the solids, and thus were fixed and tenacious. The Continued fevers were divided into the following forms: (1) Ephemeral; (2) Epialus—rigor and heat; (3) Synochus—continuous; (4) Typhoid—stuperose, "phrenitis"?; (5) Causus—ardent, sordes; (6) Lipyria—internal heat, not outward; (7) Rhoōdes—dysenteric; (8) Icteriodes—with jaundice; (9) Nothros—torpid, epistaxis; (10) Phricodes—heats and chills, windy.

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[1] Quoted by W. H. S. Jones, *Malaria*, and *Id.*, *Gk. Hist.* Bk. i.

That *Malta Fever* prevailed in Central Italy under the Empire may be surmised. We have no evidence worth the name for or against the assertion. However it is not unlikely, and may suggest an interpretation of some of the indefinite and prolonged fevers which we are unable to identify.

Dysentery was well known in Greek and Roman medicine from early times, and continued in Western Europe all through the Middle Ages; but it seems not to have been conspicuous in Great Britain before Renaissance times. In Rome Celsus gives a good account both of its symptoms and pathology, and describes the ulcers of the intestines, the discharge of sanguineous mucus, and the tenesmus. There is a no less intelligible account of the disease in Dr. Budge's Syriac MS. (p. 144), a Greek treatise of the Alexandrian period in which the author applies to the discharge our familiar phrase of "meat washings"; he gives endless prescriptions for it, many being of the most cumbrous and futile kind.

Anthrax is an old epidemic, and seems to have been much more frequent and destructive in the past than is generally realised.[1] Richter argues that many epidemics in medieval and ancient history were Anthrax; and this may be true. Such an epidemic, which some however suppose to have been virulent influenza, is alluded to in Pirckheimer's *Letters*. Some passages in the Hippocratic Corpus may refer to this disease—*e.g. Epid.* ii. 1—on an outbreak in Cranon, in a hot wet summer, of boils that became intensely inflamed and formed blisters. In Exodus (ix. 9) we read, in the English Translation, of *a* boil, and in *v.* 11 of *the* boil, breaking forth with blains upon man and beast; not forgetting the magicians themselves. When in the records the well-known enlarged glands are not mentioned, the diagnosis of bubonic plague may probably be excluded. Some epidemics, such as we read of in the later Empire, may have been erysipelas or anthrax—the *πῦρ ἄγριον* might mean either. Ovid gives a vivid narration of a terrible plague which afflicted man and beast; the wretched ploughman saw his strong oxen fall in the furrow;[1] dead animals lay rotting in the fields, and their "exhalations fed the infection." The pulmonary form of anthrax is of course a swift and deadly pestilence. It has been argued of late, not without some plausibility, that the plague of Athens, as described by Thucydides, was anthrax;[2] and so again the outbreak in the Carthaginian Camp at Syracuse described by Diodorus. To this question I will return presently.

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[1] Richter, *Arch. f. Gesch. Med.* Bd. vi. See also for Medieval and Renaissance periods *A.f.G.M.* Bd. v. and E. Reicke, *Eine ratselhafte Krankheit des Jahres 1527.*

Typhus Fever was no doubt one of the scourges of ancient as of modern times; the sharp crises attributed to such critical days as the seventh and fourteenth, and the fixed belief in such critical days, suggests a predominance of typhus and relapsing fevers, and of pneumonia. Dr. Moor has argued[3] that the contagious plague which broke out on the accession of M. Aurelius, and was described by Galen (A.D. 165), was typhus; it was said to have resembled the Thucydidean pestilence, and to have been preceded, as were the plagues of Egypt, by storms, earthquakes, and clouds of locusts. As it lasted some fifteen years, it was known as the Long Plague.[4]

The great and sudden plague of Athens in the second year of the Peloponnesian War (430 B.C.) admirably described by Thucydides, and again by Diodorus who deals especially with the causes, only falls within our period so far as it signified a pestilence which may have been one of the many by which Rome also was harried. Thucydides puts prominently forward the blood-red colour of the tongue and throat, and the crisis on seventh to ninth day, which suggest malignant scarlet fever. Dr. Collier, a scholarly physician of the beginning of the nineteenth century (*Hist. of Plague of Athens*, Lond. 1857), argued not without reason for malignant scarlet fever as the plague of Thucydides. On the other hand famine and overcrowding, due to the compulsion into the city of all suburban people and their cattle by Pericles on the Lacedaemonian invasion, and to their lousiness, were eminent among the causes which turn our thoughts rather to typhus.[1] The Anni Santi in Rome were too often followed by a pestilence. In 1900, after the arrival of the Piedmontese pilgrims, influenza—previously slight—rose to 60,000 a week. It is true that the Athenian plague seems to have been something of an epizootic; though this statement, unless in respect of household dogs, is not very clear. The protective effect of an attack is consistent with either disease; though on the other hand recrudescences of the epidemic seem to be to the contrary. And is it likely that all, or the majority, of the cases would have been of a malignant type? Certainly—so far as our records go—the Roman pestilence of A.D. 165 described by Galen, in manifestations and causes resembled that of Athens, and likewise the typhus of our own times.[2] Thucydides spoke of the sores or phlyctenulae as small and multiple, which seems against anthrax, and is not easy to recognise in any pestilence known to us. He makes no mention of buboes, a far more conspicuous symptom. That this or the other pestilence was a disease now extinct is a guess that in my opinion should stand last.

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[1] Concidere infelix validos miratur arator
Inter opus tauros, medioque recumbere sulco.
(Ov. *Met.* vii. 523-60.)

[2] F. Jahn, of Meiningen in the old *Janus*. Breslau, 1846.

[3] Moor, Chadwick Lect. *Lancet*, June 3, 1916.

[4] See Anglada's *Hist. of Epidemics*.

On the many well-ascertained and terrible epidemics of *The Plague* I need not dwell. These outbreaks, as for instance that, perhaps the worst on record, in the time of Aetius in the sixth century, under Justinian, which persisted for two generations, ravaged not Italy only but, as we learn from the very full description of Procopius (ii. 24), Germany, France, and Constantinople also. Justinian was himself attacked, in the bubonic form, but recovered. The buboes are better described by Procopius than in Hippocrates, or by Galen; but Galen wrote from hearsay only, and scandal says that he took care it should be so. The epidemic began in Egypt, raged in Alexandria and eastward, and reached Constantinople in the second year; there it held on its way under the Palaeologi, and thenceforward into the Middle Ages, and later. With the exception of some minor precautions by a few states, such as Venice, against sick and suspected travellers, no quarantine was imposed until 1383, at Marseilles. In the plague of Nero's time the mortality was terrible; although, as Tacitus says, "Nulla caeli intemperies quae occurreret oculis." But the descriptions are very meagre. Smallpox was mentioned in the fifth and sixth centuries.

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[1] "Plague of Thucyd.," *Ztsch. f. Hyg. u. Infkr.*, Leipzig, 1918, lxxxvi. 297; *Bull. Johns Hopk. Hosp.*, 1919, xxx. 38; also *ib.* Richter, 1918, lxxxv. 459, 72-80 Eliz. Frg.

[2] See Corlieu, *Peste d'Athènes*, mars, 1884.

Rabies [1] seems first to have been distinguished as a definite malady in the time of Asclepiades, though there are earlier allusions to such symptoms (Pl. xxiv.). Apparently it was unknown, as such, to Heraclides of Tarentum, from whom therefore Celsus could not have obtained his information about it. Celsus rebukes the barbarous treatment of plunging the patient into a tub of cold water; a proceeding that before him Asclepiades had rightly denounced. Pliny's account of rabies was but at second hand.

Tetanus was explained by Diocles as a stoppage of the pneuma in the nerves—he might have made a worse guess. The long vogue of its treatment by musk came through Heracleides of Tarentum to Celsus, to Soranus, and so later.

The *morbus cardiacus* (pulse small and weak but heart throbbing) seems (Asclepiades, Soranus, Galen) to have been not a local—cardiac—but a constitutional malady with vasoconstriction. The pneumatists called it cardiac syncope: possibly our new friend D.A.H. ?—or Graves' Disease (see Frieboes, *Celsus* 514). Landsberg (*Janus* ii. 53) regards it as Chlorosis.

I need not say that *cynanches* of all sorts—probably from Hippocrates including diphtheria—occupied many a page of ancient medical authors and that much was made of their treatment.

That *Pulmonary tuberculosis* — "consumption" — was rife, and a permanent scourge in Greece and Rome, we know; an interesting reflection upon it is that it was then regarded as infectious, as catching from person to person. This belief I found was prevalent, if not universal, when in the later 'fifties of the nineteenth century I first travelled in Italy; and is still more actively held there than by ourselves. It was not the least of the sorrows of a young Italian, with whom in those days I was acquainted, that on account of this malady he was tacitly shunned by all his neighbours, whether on travel or at home. Galen describes the tubers (*φύματα*) in the lungs.

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[1] *Lyssa* (λύσσα) before Xenophon's time, was used only of rage and fury (in the *Iliad* of martial rage), especially if caused by a god (L. & S.), as by Hera in the *Hercules Furens*. Xenophon however used it of canine madness. By the way, the Master of Emmanuel College (P. Giles, Litt.D., *Proc. Camb. Philol. Soc.*, 1916) has pointed out how admirable is the portrayal of maniacal fury in the *H.F.*; great mental disturbance with fits of maniacal excitement [and delusions of persecution, C. A.] and calm intervals.

The question of the existence of *syphilis* in Graeco-Roman times has been reopened with the new suspicions of the presence of the disease in Europe before the discovery of America. I ventured to ask Mr. Warde Fowler what he thought of the bibliophile Jacob's statement. His answer was as follows: "In my judgement the question depends on the evidence of Celsus entirely; all the rest which Jacob adduces is vague and indirect, and apt to give way when you probe it. For example, he makes a great point of slave doctors kept in big establishments, who would keep unpleasant diseases secret, and so on. I have looked up the evidence about these, and there is nothing more in it than that in a few very big establishments it was convenient to have a doctor on the spot, as in a big ship. The economy of those big households or farms was self-sufficing, in this as in other ways. And it was far from universal even on large farms, for Varro expressly says that farmers preferred to use the doctors of the neighbourhood. Again, he quotes St. Augustine for the Syrian luxury that came to Rome in the second century B.C., and jumps to the conclusion that all kinds of evil diseases came with it. That may have been so, but it does not come out of Augustine's words; and I am pretty sure that if Augustine had wanted to say so, he would have said it without any scruple. But, on the other hand, supposing that the passage quoted from Celsus distinctly points to syphilis or something like it, the fact that there is no mention of such things in Roman literature would not be enough to damage Celsus's evidence. What survives of Roman literature is mostly clean and in good tone, and one would not expect to find any such allusion in it. The absence of any allusion in certain poems of Catullus, and in the great passage about love at the end of the fourth book of Lucretius, might suggest that one should be careful about interpreting Celsus, but would by no means be decisive. (I have just been over the Lucretius passage, and can find no trace of allusion to a morbus; and L. was very plain-spoken in such matters.) So I think that you must go by Celsus alone. Apart from him I should say there is no evidence of any weight, positive or negative." The difficulty with Celsus is a matter of interpretation. The lesions described are not necessarily sexual.

Hysteria seems to have been well known in Rome, so much so, that the women so diagnosed it and gave it that name themselves! Galen says, *ἐγὼ δὲ θεασάμενος πολλὰς γυναῖκας ὑστερικάς, ὡς αὐταί τε σφᾶς ὀνομάζουσιν* (Kühn, vol. viii. s. 416). The description of the hysterical suffocation corresponds to the "ball rising in the throats" of our grandmothers; the malady has now fallen into discredit.

Digestive diseases were, as we may suppose, very common.[1]

From the time of Hippocrates to Demetrius Papagomenos, and from him to our own age, *gout* has been the chief example of a disease of the humours. The ancients were acquainted with some of the visceral manifestations of the disorder. Hippocrates said women had not the gout before the menopause (*Aph.* xxix.)—to Seneca's surprise who remarked that the Roman women earned it much more quickly.

When we turn to *surgery* in Rome we come to a very different condition of historical knowledge. Descriptions are naturally more definite, and procedures more direct and accurate, than was then possible in internal medicine. The surgeon is compelled to tackle concrete and obvious evils, and is necessarily more practical and his pathology more rational. Thus even in ancient Egypt there was fair surgery. Professor Elliott Smith has shown what good splints they devised.[2] The Hippocratic treatises on Fractures and on Dislocations are masterly, and became the classics of the doctor in Rome. A like mastery we find also in the tradition through the Alexandrians to Celsus, who also names his sources. In later Byzantine times, by the link of Philumenus (p. 278), the tradition persisted, but more obscurely, until it awoke again in Salerno and the West; especially in

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[1] See *Inaug. Diss.* by A. G.—the full name I have mislaid—Wurzburg, 1912: clear and able if not exhaustive. See also M. Steineg, *Arch. f. Gesch. Med.* Bd. vi., Apr. 6, pp. 54-85; the third of a series on Galen's physiology.

[2] Elliott Smith, "The Most Ancient Splints," *Brit. Med. Journ.*, 1908, i. 732.

France.[1] In the Early Empire surgery seems to have attained a high proficiency in the hands of such masters as Leonides, Heliodorus, and Antyllus; though much of its literature has perished, a matter of great regret. We find in Oribasius, and in the Sixth Book (c. 33) of Paul, how carefully such operations as laryngotomy had been devised and counselled; *e.g.* Antyllus refused to operate unless the air-passages below the place of incision were normal. The operation was known to Asclepiades, who however regarded it as a last resource. Antyllus fixed a limit of diameter for operation on aneurysm; in too large vessels, such as the axillary or the iliac, the "force of the pneuma" was apt to burst the ligatures. Moreover, he operated rather on the saccular than the fusiform kind. He operated on cataract by extraction. To the variety of operation we have an eloquent testimony in the extant surgical instruments, such as are still to be seen in the Vatican, and in the Museo Borbonico at Naples. An array of such instruments is to be seen also in London, in Mr. Wellcome's Museum.[2]

Pleuritic empyema was well known in the days of Hippocrates, who used the knife to let out the pus. Later surgeons, as we find in Paul's Sixth Book, used the cautery; but for this disease operation seems thenceforward to have gone out of fashion. Galen knew of the occurrence of suppuration in the pericardium also (see Galen, K. xviii.). On *pleurisy* Soranus says (Cael. A.), "sonitus interius resonans aut sibilans in ea parte quae patitur." The phases of the surgery of empyema are curious. If in Celsus's day it had fallen out of use, Heliodorus described it, and was used to wash out the cavity; then Galen and the Byzantines were silent about it, or nearly so, and thus it fell into disuse till restored by Trousseau. As his pupil, I restored the operations of thoracentesis and incision to England (at Leeds); Roberts followed in Manchester, and our friend Bowditch performed and advocated these operations in New York.

Operations for *hernia* (and the use of the truss), known from the time of Hippocrates and Celsus, and very carefully performed by Heliodorus, never ceased, but in later times fell largely into the hands of peripatetic quacks who performed them too often in brutal fashion, not sparing the testicles. Of such also were the peripatetic cutters for stone, cataract, couchers, etc.; some mere pretenders, others surgeons' underlings: a crowd, at best, of specialists without cohesion, discipline, or body of doctrine. Hippocrates had written well on urinary diseases; he diagnosed stone in the kidney; Aretaeus in the ureter. Alexander of Tralles distinguished between diseases of vesical origin and those higher up the tracts.

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[1] See Allbutt, *Hist. Relations of Medicine and Surgery*, London, 1905.

[2] See Milne, *Surgical Instruments in Gk. and Rom. Times*, Oxford, 1907; Sudhoff, *Mitth. Gesch. Med.* vol. vii., 1908; and Meyer-Steineg's description of his own collection in *Jenaer med. hist. Beiträge*, Heft i. Gurlt is very good for Hippocratic Surgery; the later chapters are less thorough.

A very characteristic feature of the Romano-Greek surgery, after the manner of the Greek mind, is the insistence in their surgery upon special exercises, manipulations, orthopaedic, and "first-aid" methods. The treatment of flatfoot, for instance, is fairly up to modern requirements. Bandage-craft, inherited as we may suppose, from the Egyptian mummy experts, was elaborate and manifold.

In certain papyri of the first to third century in Berlin Museum (ed. Kalbfleisch and Schöne) are some interesting aspects of surgery. In M. 9764 one Dr. Archibios complains that surgical teaching, instead of setting out with practice starts with theoretical and historical instruction. He urges the teacher to begin with a demonstration of the mechanical conditions to be dealt with and thence to show how by simple manipulations the end can be attained.

If Celsus (v. 26) were the first author to mention ligature, the method was known long before; torsion, taught by Herophilus, was practised by Rufus, Soranus, Heliodorus, and Galen (Oribasius, *Aet.* xiv. 52) (p. 284). Trephining is a very old story; if primitive man performed it by means of a flint-scraper, the Greek surgeons seem to have drilled a circle of holes and then cut them through.

But I must cut short this slight and incidental and rather unintentional gossip about particular diseases.

CHAPTER XVII

PHARMACY AND TOXICOLOGY [1]

PHARMACOLOGY, so lately awakened from a long slumber, is a very ancient study; but *pharmacon* meant, if perhaps not originally as in Homer, yet very early in its history, not a remedy but a poison; [2] a meaning which casts no pleasant reflection upon our remoter ancestors. We must not suppose then that even in its experimental sense, "pharmacology" is a study only of yesterday, a study created by modern research; [3] this is by no means the true story of it: from early times, at least as far backward as the reign of Mithridates Eupator (*c.* 100 B.C.), experimental pharmacology, with iology (the study of venoms), if not very methodical was at any rate a busy and very fashionable pursuit. In and about the second century B.C. a prodigious number of experiments were, and had been, made with drugs and venoms on animals and condemned criminals, and by experimenters on themselves, not to mention their personal enemies; thus a large bulk of only too effectual, if not very precise, knowledge of these agents was compiled.

It appears that poisons were taken into use first from venomous animals, probably as arrow poisons; after these the more accessible vegetable poisons were discovered; lastly, mineral poisons were obtained, the knowledge and use of which depended upon a somewhat advanced state of the arts.[4] It is remarkable, as Eric Harnack has pointed out,[1] that, although poison literature is mainly and primarily of oriental origin, and was conveyed thence to Southern Europe, yet in the Bible we find but little allusion to the use even of animal venoms, still less to the virus of plants; [2] and we may say almost the same of Egypt. Indeed in the *Iliad* we learn nothing directly of poisoned arrows, though the darts of Apollo are probably so to be regarded; [3] the Achaeans however were not an oriental but a northern and more or less chivalrous people. Albeit we know, and even from Homeric tradition infer, that the origin and use of poisoned arrows, as of magic philtres and potions which really were poisons —often, Harnack thinks, containing belladonna (or its congener mandragora)—go back to the far distances both of time and space. In the *Odyssey* (δ 230) "nepenthe" is said to have come from Egypt, a country rich in opium and other poisonous plants, and in doctors; and we remember (α 260) that Ulysses went to Ephyra in Epirus to find there a mortal arrow-poison. In later times, in the *Agamemnon*, Cassandra uses the metaphor of brewing a pharmacon. Again in Sophocles we have the story of Philoctetes and the (poisoned) arrows of Heracles. The Parthian arrows were poisoned. In the *Trachineae* we find the legend of Deianira and the poisoned robe of Nessus, who had himself been poisoned by an arrow steeped in the blood, or gall, of the Lernean water-snake. In Euripides it is enough to allude to the *Medea* and the *Ion*. From such sources we derive two articles of belief among the ancients, beliefs handed down to later centuries: first, that the blood, flesh, or secretions, nay, even the look, of a venomous animal was virulent; [4] secondly, that if, let us say, viper's flesh were poisonous yet that the flesh of the same had the virtue of conferring immunity. The first article was of course a "vulgar error"; the second however, if in the Greek a fable, for our generation is a remarkable, if often fantastic anticipation of the doctrine of immunity, a notion probably founded on some experience: to this tradition I shall return presently. So far as I remember, the ancients did not distinguish between the entries of a poison by a wound and by the stomach. Indeed it was not until the discovery of the dental poison gland of the snake, by Redi in the seventeenth century, that the local store of this venom was perceived.[1]

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[1] No part of this chapter was delivered in the FitzPatrick or other Lectures.

[2] If *pharmakos* in the sense of a "scapegoat" be primarily akin to *pharmakon* (medicine), historically speaking the words have little in common; the link may be in exorcism.

[3] Magendie may perhaps be regarded as the first modern pharmacologist? Early in the nineteenth century he experimented with upas, a thorough analytic study. He studied likewise the absorption of metallic poisons by the blood. Then came Claude Bernard, Kölliker, Mitscherlich, Buchheim of Dorpat, etc.

[4] Galen (xv. 134) says that mineral remedies were prescribed by Crateuas (end of second century B.C.). See p. 366.

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[1] *Das Gift in d. dramat. u. antiken Literatur*, Leipzig, 1908; a tract of 78 pp. to which I am indebted; although the quotations and references needed much verification and revision.

[2] There are of course a few allusions, as *e.g.* in Gen. xxx., the use of mandrake as aphrodisiac. But in the time of Hippocrates the herb was not credited with magical virtues; it was known in medicine chiefly as an anaesthetic for surgery; and, like henbane, it was an ingredient of Shakespeare's "drowsy syrups."

[3] The word for poison, *τοξικόν*, indicates the relation to the arrow. Prof. Gilbert Murray (*Rise of Gk. Epic*, p. 120) suggests that although the use of poisoned arrows had in that age become an unchivalrous and barbarous practice, yet epithets (*e.g. ἄφυκτος*) of the poisoned arrow were still used of arrows in Homer; while the horror of arrow scratches points also to an earlier time in Greece when the primitive inhabitants used them. See *Il.* Δ 139 and E 104 and Soph. *Phil.* 105. Lucan writes: "Insolitusque videns parvo cum volnere mortes (*Ph.* ix. 736).

[4] Actius thought it superfluous to write down supposed remedies against "the basiliske, as to see and hear it only was mortal." Paré, in his twenty-first Book, says that venomous animals harm not only by bite or sting, but also by their excrements; such as spittle, blood, touch, and breath. In chap. xix., he says this of the cockatrice, on the authority

In the Second Book of the *Laws* Plato points out two kinds of poisoning: one physically morbific, according to natural laws, the other psychologically lethal by sorceries, incantations, magic bonds, "waxen images," or mere suggestion.[2] The effects of these influences upon believers were terrible, and to this day they make even sceptics uncomfortable. Plato pronounces that if a poisoner be a physician he shall be put to death, a judgement that the Medical Council would ratify to-day; if he be not, he shall pay or suffer according to the judgement of the Court: so again if one who injures another by witchcraft be a prophet or diviner he shall die; but if the miscreant be of another profession he shall be dealt with at the discretion of the Court. Socrates was almost surely poisoned with conium; indeed we have a note of the prescription.[3]

When we come to the Greco-Roman period, with which we are directly concerned, I will but allude to the infamous practices of poisoning under the Roman Empire. After making allowances for false suspicions of poison in many a sudden death from natural causes, such as acute appendicitis, perforation, aortic regurgitation, etc., still the very vogue of these suspicions betrays the

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of Nicander. It is true that the cutaneous (and parotid) glands of the toad and salamander throw off, when the animal is irritated, a mild defensive venom. We see the effects of it by the frothing mouth of a dog that has bitten a toad. The poison is an alkaloid; not a proteid as is that of the serpent (Hewlett, *Sci. Progr.* N. Ser. vol. i. 1897).

[1] Redi of Arezzo, an able biologist, was a professor at Pisa. He demonstrated, in 1664, the poison and bane of the snake, and the structure of the tooth as poison carrier. It was thus that the poisonous quality of the flesh or skin was discredited. Yet Cato had declared of a well inhabited by serpents, that the water would be harmless: "*Pocula morte carent.*" (See also Lucan, *Pharsalia*, v. 614).

[2] For instances, see Rivers, *FitzPatrick Lectures.*

[3] See Theophr. ed Hort. ii. ix. 16. 9, the prescription of Thrasyas of Mantinea, consisting of juices of hemlock, poppy, etc. The hemlock was decorticated, bruised in a mortar, and then rubbed through a fine sieve.

prevalence of such devilry. Whether Domitian did poison Titus or did not, his contemporaries found no moral difficulty either way. Even Cato, in that earlier time, spoke of the adulterous wife as a poisoner. Seneca, in one of many passages (*Ep.* cxix. 16; quoted E. H. *loc. cit.*), writes, "Sons poison their fathers, wives their husbands." So in France under Lewis XIV. we read of the *Requiescat in pace*; and of the *Poudre de succession*, which was supposed, like the "mortal mineral" in *Cymbeline* (v. v.), to have contained lead. Horace's Canidia was witch and poisoner. In the *Georgics* (iii. 284), we read, "*Miscueruntque herbas et non innoxia verba.*" Claudius was got rid of by poison. That such scandals should have come under the lash of Juvenal we might well have expected; he says (*Sat.* i., vi., xiii., xiv.) that the Roman matron can outdo Lucusta at her own craft—Lucusta, executed by Galba only too late, after she had taught the art to Nero, and provided the means of removing Britannicus, who was probably poisoned at Nero's table. Cicero narrates of one Oppianicus, a person who seems to have kept his private accounts carefully, that he bought of a druggist of Ancona, for 400 sesterces (say £3), a poison which neatly disposed of his mother-in-law. Indeed druggists selling such poisons went about openly at fairs. Juvenal mentions aconite as the poison used by a mother to poison her children for their inheritance; and says that poison and sorcery walked hand in hand. We cannot wonder that, by persons who had reason to fear the poisoner, antidotes were taken regularly with the meals. Cambridge still possesses three of the cups which were supposed by some signal to betray poisonous contents. A cup of rosemary wood was said to neutralise any poison put into it. Although both these curses, poison and sorcery, came to Greece and Rome chiefly from the East, and the northern races, so far as they shared in such crimes, did so at second hand by imitation of the Romans, yet we read also in Lucan (*Ph.* vi. 438 ff.) that these foul practices (*herbae nocentes*) found their way into Rome (in the first century B.C.) with other witchcrafts from Thessaly.

If we may judge in part from the absence of this kind of crime from the *Inferno*, we may presume that before the thirteenth century it had fallen into abeyance; in the Middle Ages the discredit of reviving the art and lore of poisoning in the Mediterranean lands would appear to belong to the Arabs, whose wares found only too ready a sale in Venice and other markets of

Italy. How rife this accursed cunning became in the Renaissance period we know but too well. *Qui mange du Pape en meurt*; and from the infection, if we may judge from the Elizabethan dramatists,[1] the Italianate Englishman was not wholly exempt. Even Chaucer, 200 years earlier, had carried over from Boccaccio and other Italian sources, some story of these practices; as likewise of astrology and alchemy. The "Asiatic pills" probably contained arsenic; and this drug, usually conveyed in the coffee, is still the favourite means of poisoners among the Moors and other oriental rascals.

The artists professed to work on three methods—of acute poisoning, of poisoning with a drug supposed to set up a lingering morbid illness ("With no rash potion, but with a lingering dram" Camillo, in *W. Tale*; and *Mids. N. Dr.* I. ii.), and of chronic poisoning by repeated fractional doses of the bane, as by a course of arsenic or lead. The expert mixers pretended also to be able to prepare such a prescription as, once started, would, like a time-fused shell, kill at a given forward date; a pretension discredited by Paré who justly opined that, not only had the poison to be calculated, but also "the subject upon whom it lights, who may more or less resist or yield to its efficacy" (bk. xxi. c. 3).

I have drifted down-stream from Romano-Greek times, not without a purpose; by this digression some glimpse is given of the long record of poison lore; of its momentous social history and tradition, its clews, and its bearings on natural, medical, and scientific history. To return now to the historical and scientific aspect of the matter: in the Greco-Roman period with which we are presently concerned we have seen that the arrow was the earliest vehicle of poison—the Veddahs, Dr. Haddon says, had not reached even this modest stage of civilisation—and that to the banes of venomous animals those of poisonous plants and then of minerals were gradually added; and again that the farther we go back in ancient times the less we find of vegetable poisons and more of animal, which are much more readily prepared. As certain savage tribes possessed secret poisons to help their magic, so out of the potent herbs gradually arose the idea of some such materials as remedies; whence again, especially in plants, came the discovery, real or supposed, in certain less virulent substances, of antidotal or remedial qualities. As our sometime Public Orator in Cambridge, George Herbert, profoundly said: "Herbs gladly cure our flesh because that they Finde their acquaintance there." Long before the times of which we have documentary knowledge, Egypt was rich in medical plant lore, "the glory and name of good hearbs"; she possessed "the noble nepenthes . . . for easement and remission of all sorrows" (Holland's *Pliny*, xxv.)

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[1] We need not look farther than *Romeo and Juliet, Hamlet, Cymbeline, Lear,* or again *Henry VI.* (III. iii.). On drugs and *telae* for abortion see Ov. *Amor.* ii. 14. 5.

From very early to comparatively late periods of history poison lore and leechcraft were closely associated, often indeed identified, with witchcraft. And if we look out on the world we shall find this blend still active, not in very barbarous peoples only; indeed in Western Europe it was not until centuries too recent to make quite a comfortable reflection for us, that leechcraft was stripped, if entirely stripped it be, of sorcery. To this day we have among us herb-gatherers who, in culling certain simples, observe the phases of the moon; for "Artemis was a kind of a witch with a herb garden," and had her arrow poison. She was patroness of medicine and magic, "artemisia" (wormwood) being one of her most powerful charms.[1] In later times the plant was to be plucked on St. John's Eve, and worn in the girdle—"Diana's girdle." Of the terrific fables invented by the traders of spices, drugs, and other wares to frighten away rival merchants—of the flying serpents, the ants not so large as dogs but rather larger than foxes, and so forth, we know from the pages of Herodotus and other chroniclers. The mandrake stories are too familiar for repetition. Theophrastus throws ridicule on the pretended perils of collecting peony, iris foetida, and hellebore.[2]

But times and times have been, peoples and peoples: of all such superstitions the luminous and decisive mind of the Greek, even in Rome, carried him clear, or almost clear. Whatsoever their literary attraction, or their profit in medical practice, he purged his science of them; so that on the whole, and overlooking a few mysteries and many scoundrels, we find the Greek pharmaceutical tradition down, let us say, to Alexander of Tralles (sixth century), rational, clean, and practical. Even if we look backward to the ancient Aegean cities, we shall find, above the superstitions of the lower classes, a rational, and even scientific, handling of medical subjects. In the Homeric hymns, it is true, there was something to purge away. For instance, in the Demeter hymn we find that many illnesses, especially the more startling, such as fits of all kinds and insanity, the swift deaths or stealthy marasmus of children, and the sudden deaths afterwards more rationally, if falsely, attributed to poison, were then imputed to sorcery, and were to be countered only by the same means. The wonderful thing is the clean sweep of it all by the Ionians (p. 79), before Hippocratic times. Thus for the historian the pharmaceutical tradition becomes a valuable instrument; for by its definite items, and the continual habit of oral tradition and plagiary (p. 272), we are enabled to track out the sources and streams of medical knowledge as medicine traversed each generation, and descended from one to another.

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[1] Rendel Harris, *Artemis*, 1916, on immunity as a condition previous; and on isopathy as remedial. Lucky Gourlay's pharmacopeia consisted partly of herbs collected in planetary hours, partly in magic, signs, words, and charms.

[2] *E.g.* *τὰ μὲν ἴσως οἰκείως τὰ δὲ καὶ ἐπιτραγῳδοῦντες λέγουσι*: and in another place: *τὰ τοιαῦτα ὥσπερ ἐπίθετα καὶ πόρρωθεν* ("Such stories are extravagant and far-fetched").

I have alluded to the curious old doctrines of immunity as of a condition antecedent to and preventive of "isopathy"—the "hair of the dog that bit you"—a kind of doctrine which seems to anticipate not only the homoeopathic axiom of *similia similibus* but even the modern theory of immunity. How far is it true that the immature seed of a doctrine that in our time has suddenly grown into a tree, was sown in early ages, and has in its rudiments survived? That the search of antidotes on the opposite principle of *contraria contrariis* should have been likewise an immemorial study is easier of comprehension. However modern notions are not to be applied too easily to the interpretation of ancient ideas. The doctrine of isopathy is really akin to the doctrine of "sympathy" which, like "isopathy" itself, had so prodigious a vogue in the Middle Ages. Thus the laying on of the sword, or even the rust of it, healed its wounds; the blood of the Gorgon healed its bane; and so on: these and such beliefs survived through the Romano-Greek period and long afterwards.[1] Among the earlier monuments of isopathic doctrine we read of the brazen serpent in the wilderness; of the dedication of the golden emerods, or buboes, to stay bubonic plague; of Apollo the guardian against wolves and Apollo the wolf; of the offering of mice to Apollo Smintheus; of Dionysus as the bull-slayer and as the slain bull; of the Gorgon; the active thus alternating with the passive; and so on, for endless examples. Spiders—not the tarantula only—were regarded up to comparatively recent times as deadly poisons, and the spider accordingly had its virtue as an antidote or charm: *e.g.* "And tho' (the Soul) when it was a spider and could not speak, yet it can remember and now tells me who used it for poison to attain dignity" (Donne, *Progr. of Soul*). Viper's flesh entered into the composition of perhaps all the theriacs, or panaceas; of all at any rate which were taken as antidotes to poisons. The viper, taken in spring, was skinned, the head and tail were cut off, and the flesh was boiled with dill and salt; this product was kneaded up with toasted bread and served in boluses. The squill (Cephalopod) was prepared and administered much in the same way, but not as an antidote to poison. From these isopathic ideas may have been derived the use of some of those ingredients of old recipes which to us seem, and are indeed, loathsome; such as *bufones exsiccati*, dungs of animals,[1]—roasted asses' dung for instance, scraps of their flesh, viscera, or cutaneous excrements; and so forth.[2] These and such practices are by no means obsolete; to reach into space is to turn back into time. Oriental people, *e.g.* the native tribes of North Africa, to attain immunity from the bite of serpents, swallow the venom and devour the reptiles; a tradition perhaps derived through the medieval University of Fez.

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[1] Cf. *Canterbury Tales*, "Squiere's Tale," i. 10,471 *et seq.*, and *Rich. II.*:

> "slander's venomed spear,
> The which no balm can cure but his heart blood
> Which breathed the poison."

(These two quotations I owe to Eric Harnack.)

Allied to these quasi-magical remedies is the immemorial belief that to eat of an animal, or to drink its blood, is to absorb its peculiar virtue; as of strength from the heart of a lion, cunning from the heart of a fox, cowardice from the heart of a hare; and so on. The various modes of blood brotherhood, and of cleansing by blood, spring from a like source. The ramifications of these fancies are endless, and lead away into such mystical labyrinths as theophany and totemism.

The explanations of the remedial actions of these queer remedies were as grotesque as the things themselves. In one feature of the poison lore we find some true anticipation of modern pharmacological knowledge; namely, the establishment of tolerance of a poison by gradual habituation of the body to its presence. Theophrastus (Περὶ φυτ. ix. 17), tells a story of a quacksalver,—who before the people in the market had boastfully eaten two roots of hellebore with impunity—that a passing shepherd, "cunning in herbs," swallowed a whole bundle of them, and so promptly destroyed the pedlar's reputation. Thus, says Theophrastus, when the constitution has accepted poisons, and prevailed over them, they cease to be poisonous: and what is poison to one is not so to another.[1] He gives other examples likewise. Although the idea was no longer that of isopathy, or of a confusion between agent and effect, or again of the breaking of a spell, yet it may have arisen out of it, and been fortified by experience: even indeed by systematic experiment. And the way of entrance of this doctrine of immunity into the mind of the ancient inquirer was by an open door; that by practice various difficulties can be overcome and capacities created is in all ages a familiar experience. One of the antidotes of Mithridates[2] was the blood of ducks which in Pontus fed on poisonous herbs; rather a wild but by no means an absurd idea. It is said that Pontus was rich in baneful vegetables.[3] Notwithstanding, between the ideas of "isopathy" and "sympathy" and of the cure of *similia* by *similibus* in the homoeopathic sense, there is not much in common; nor, save incidentally, could the superstition of the one lead directly to the pathology of the other. It has been said, it is true, that the ingredient of serpent's flesh in theriacs was introduced on the hypothesis of immunity; namely, that the serpent's flesh must have become inured to the presence of the venom circulating in it; the narrow seat of the poison under the fang being then unknown. This may have been the notion of later pharmacists, such as Galen and his successors; but serpent's (usually viper's) flesh as a remedy or prophylactic against poisons was much older than the notion of immunity by established use. It began in isopathy, in the idea that to eat the serpent's flesh was to partake of the supervenenic virtue of the creature, as to eat the lion's heart of its courage.

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[1] We read of traders so smart as to have adulterated the crocodile's dung—in Europe hard to come by.

[2] Dr. Crawford says he has seen a shepherd apply fowls' dung to the sore back of a sheep. (*Lancet*, Dec. 30, 1916.) The application of cobweb to a cut was a comparatively rational styptic.

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[1] For many antidotes gathered from observation of animal instincts and immunities, *e.g.* of rabbits to poppy, of cattle to hemlock and henbane, etc., see Aelian, *Nat. an.* v. 46.

[2] See Pliny xxv. 3 and Aul. Gell. *N. Att.* xvii. 16.

[3] Many readers will remember the serpent (*Aen.* ii. 471), "mala gramina pastus"; a translation of a far older verse (*Iliad* xxii. 93): "βεβρωκὼς κακὰ φάρμακα." See also Aelian, *H.A.* vi. 4 (quoted Leaf's *Iliad* ii. 355).

Poisoning did not lack the patronage of the great; it has been the sport of kings and the trade of knaves. Among the royal poisoners, omitting Popes as not exactly royal, we find among sportsmen Attalus the Third of Pergamon (Philometer) who "flourished" in the second century before Christ, supreme. Galen bears witness to his ardent research in poisons and antidotes, and to the experiments he made upon "criminals"—or shall we say captives? Among the poisonous herbs then in use were henbane, belladonna, hemlock, monkshood. Nicomedes, king of Bithynia also, his contemporary, was a virtuoso in the same arts; and before him flourished another royal pioneer in the craft, Antiochus Epiphanes, king of Syria (d. 164 B.C.). Of the following generation, I have already referred to the notorious Mithridates Eupator, king of Pontus, contemporary of Crateuas (p. 366), a "mighty and puissant prince" whom I fear our alienists might call a homicidal maniac. If so, he was a madman of much method, who surrounded himself, as in England our governors fail to do, with experts, and ransacked the world for banes and antidotes. After a lifetime of experiments, chiefly on methods of immunity,[1] upon animals and men, it is fair to add (on Pliny's testimony xxv. 3) including himself, he left behind him some universal antidotes, and "a cabinet of experimental records, receits and secrets"—laboratory books as we should say. At least three species were named after him. He it was who improved and developed, if he did not invent, the "Mithridaticum" or "theriac," a universal antidote to venoms, which however in his day was so far rudimentary as to include only 37 to 54 ingredients. But this modest "Mithridaticum" was the foundation of the later and more universal theriacs, of which that of Galen,[2] armed at all points, contained some 73!—"un grand médicament pour rien faire." The boluses of those, and later days, *e.g.* the "pills of Galen," were "as big as grapes," and seven to ten of them, say to cure a headache, would be ordered before and after meals! I am told that within living memory a theriac was still administered as a routine prophylactic in a hospital at Montpellier; certainly theriacs were prescribed in England in the eighteenth century, even by Fothergill.

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[1] See also Aul. Gell. *N.A.* xvii. 16.

[2] Andromachus of Crete, Nero's body physician, the first called "Archiater in the West," wrote a poem, copied in full by Galen, on Theriacs, which was one at least of Galen's sources. He prepared a Theriac of his own—Venice treacle—a great antidote, a variation on the Mithridatic; it contained sixty-three ingredients, which Galen enumerates: needless to say the obligatory viper's flesh was among them

Rational then as Greek Medicine, when brought first to Rome, may have been, among the more superstitious Roman people it became charged with mysteries, phantasies, and sorceries such as these. In previous chapters I have spoken of some of them, as of the spells muttered over the dressings of a wound or fracture. Yet notwithstanding, the story of Greek botany and pharmacy is on the whole, as I have said, not only a valuable historical tradition, but also a rational story.

Into the mists of pre-Hippocratic times we can hardly attempt to peer. Dr. Budge, from a cylinder in the British Museum, says that Merodach-Baladan II., king of Babylon (731–710 B.C.), and Sennacherib, king of Assyria, planted gardens of medical and economical plants. But of those times the history of medicine in Egypt is perhaps the most important to the medical botanist. That, as from Spanish-American sources we have imported guiacum, sarsaparilla, jalap, ipecacuanha, and cinchona, so from Egypt to Rome came medicines, especially the healing plants, and balms, such as poppy, was a tradition long before Isis tripped north of the Mediterranean. But a pharmacy, even in the mildest sense scientific, had not then made a beginning. "If," as Philemon Holland puts it, "the virtues claimed for their drugs were incredible, yet they filled their heads with a deepe conceit, forcing them to confesse that there is some great matter in hearbs." Egypt never even turned towards experiment or scientific development (Budge). On the contrary, the burden of a copious but ill-assorted and altogether empirical and traditional pharmacy, treasuring prescriptions even a thousand years old, must have lain heavily upon the Greeks of Alexandria, and in after times contributed to the long oppression of Galenism. During the bloom of the greek medicine of Alexandria the Egyptian herbal lore was probably thrust, if not into oblivion, at least into disrepute; yet, as we have seen, the Herophileans clung to drugs, and in the Middle Ages[1] pharmacy regained much of its popularity, spreading beyond Egypt into neighbouring countries; as for example into Syria. Thence by way of the Arabs, it came into

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[1] Budge, *Syrian Anatomy*, etc., vol. i. clxxiv.

Western Europe (Budge, *loc. cit.*). But if Egyptian pharmacy was stagnant, if it clung to formulas often many centuries old, if it played for safety, and was averse from experiment, and indeed from all methodical experience and "colour of verity," yet it seems to have been free from the malignity of poison lore.[1] In Egypt, says Dr. Budge, if on a patient's death it were found that he had been treated in an unauthorised manner the physician was put to death; rather too orthodox a rule but one which might have had its advantages in some periods of the Roman Empire and of the Italian Renaissance.

It is to India rather than to Egypt, which though respectable was grandmotherly, that we have to look for the origin and vogue of poison lore. There in the hands of harlots, witches, and court intriguers poisoning was rife. Venomous snakes abounded, and antidotes, if less efficient, were no less abundant. Moreover the Hindoo, being a good deal of a chemist for many a century before our era, dealt also in preparations of minerals; as of arsenic, antimony, lead, iron, and, above all, mercury. Haeser quotes from an ancient book of India—"He who uses roots and herbs is a man; water and fire a jinn, prayer a prophet, quicksilver a god." The Hindoo chemist had his furnaces, hearths, alembics, and stills, and even something of the experimental method. Those teachers were in honour who verified their teaching not only by performing experiments before their pupils but by instructing them also in the art. All other teachers were "mere stage actors." The physician gathered his own herbs, with many an elaborate ritual. The Rig-Veda mentions 1000 drugs of which 750 were herbs. Each Vedic physician had his herb garden and, like Aristotle, sought knowledge also from shepherds, huntsmen and others; and watched the ways of animals. But tolerable chemists as they were, of scientific medicine the Indian was wholly devoid.[2] It is fair by the way to add that in India more legitimate remedies, such as leeches, had been used from time immemorial; and that physical therapeutics—baths, local douches, fomentations (*e.g.* of hot sand), and cauteries (*e.g.* acupunctures of big spleens with hot needles) were in general use.

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[1] Isocrates says (Bus. Bekken's *Orat.* ii. 304): *οὐ διακεκινδυνευμένοις φαρμάκοις χρωμένην, ἀλλὰ τοιούτοις ἃ τὴν μὲν ἀσφάλειαν ὁμοίαν ἔχει τῇ τροφῇ κτλ.* ("using not dangerous drugs but such as were after the kind of foods)."

[2] R. Crawford, *Br. Med. Journ.*, Dec. 30, 1916.

In early times the Eastern traffic had been carried by the ancient trade-route to Phoenicia and Egypt, the chief mart being probably in Ceylon. In Mycenae are found Indian ivory, amber, and nephrite from China, as well as pharmaceutical vessels of foreign make and of other periods. From Pliny, Galen, and otherwise we realise that this trade to Rome of Eastern spices and drugs was of great volume (p. 25). The retail shops were chiefly in the Via Sacra (Galen's street) and the Via Unguentaria, at the foot of the Capitoline. There were signs over the doors [1] and great outside shows of roots, pictures, and so on. Three or four such shops have been identified in Pompeii, containing bottles, jars, and apparatus. Among these dealers, true to their craft, there was much trickery, adulteration, and humbug. Scribonius Largus growls over the adulteration of opium. About the middle of the second century the *materia medica*, and the shops of the public pharmacists, were subjected therefore to official inspection; first, for the Imperial household and Court, and so afterwards for the public.

In the early Middle Ages, by way of the Arabs, much of this baleful craft and trade was reinforced in Europe. In the flourishing Arab University of Fez in the Middle Ages we learn that the complicated pharmaceutical prescriptions of the later Romano-Greek schools were in use; the University possessed copies of Hippocrates, Galen, Paul, and so on. There also a gross organo-therapy was in practice; as in the use of compounds containing liver, heart, marrow, testicle, ovary and so forth, not excluding the prized human fat; and with these in similar profusion the urines of animals or man, faeces, bile, semen, saliva, etc. Semen was used as a love philtre; the liver of a rabid dog for hydrophobia, suprarenal extract for various diseases; and so on. These drugs and offals, in all their nasty diversity, were elaborated and prescribed indiscriminately for all manner of disorders by Dioscorides and his followers, and by Galen himself. Yet on the whole I think experts are agreed that, probably by the long tradition and the influence of their spiritual progenitors the Greeks, Arabian therapeutics was comparatively, perhaps remarkably, clear of astrology and magic.

When, leaving Egypt and Asia, and passing with an allusion by "the poisonous herbs of Thessaly," we return more directly to the streams of the Greek and Romano-Greek tradition, we are at first dimly aware of the semi-mythical, semi-royal figure of Melampus the Dionysiac, who drew his medicine and his magic from Babylonia; him I mention only because of the suggestion that he was the first person to prescribe iron in anaemia. The story is that he restored virility to a childless father by ordering him to drink the rust of a sword, in water, daily for ten days. He also drew upon Egypt for much of his lore no doubt, but Babylonia was his chief source, where magic and medicine were closely allied (cuneiform tablets).[1] To Melampus is attributed more reasonably the discovery of the properties of hellebore, and by it, as you will remember, was cured, at a somewhat unreasonable fee, the delusional insanity of the daughters of Proetus who thought themselves to be cows (Herod. ix. 39); an interesting trace of early half-rational medicine.

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[1] The doctors' houses had signs also; often a figure, as of Aesculapius, or Hygeia, or both; or again of Telesphorus, son of Aesculapius.

Cnidian therapeutics, whether from Egypt or India, inclined, as we have seen, more to *materia medica* than the Coan which, in more reliance upon the *vis medicatrix naturae*, used rather physical means, such as climate, waters, exercises, diet and the like. In the scope and quality of the Hippocratic writings, and by the Oath, we know that poison lore was alien to these schools, and was avoided by them. In the words of Professor Gilbert Murray, the Greek did not denounce barbarities, he simply ignored them.

But, to emerge from twilight, and to dismiss shadowy persons and things such as the Thessalian witches and their cauldrons, as we approach the light, or at any rate the dawn, we find, as it were, an academic school of pharmacists, whose lore passed by oral tradition and writing from one generation to another. By the following names and dates this succession may be made more clear:—Diocles (fl. *c.* 375 B.C.), Theophrastus (370–287 B.C.), Nicander (190–130 B.C.), Sextius Niger (*c.* A.D. 40), Dioscorides (fl. A.D. 77), and Galen being the corner-stones of the respective periods.

In the Hippocratic Collection we find no formal treatise on pharmacy. The first Greek works on the virtues of plants of which we have any record seem to have been by Pythagoras and Democritus, both of them travellers in Persia (where they consulted the Magi), Arabia, Ethiopia, and Egypt. But no trace of these writings remains.[1]

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[1] The Melampus who sought omens in twitchings and involuntary movements of various parts of the body (*παλμῶν μαντικη, vide Script. physiogn. vet.*) was a vulgar prophet of later date.

The earliest greek herbals of which we have any record are the *Rhizotomikon* ("Culling of Simples"), and the treatise on *Deadly Drugs* (Περὶ θανασίμων φαρμάκων) of *Diocles* of Athens,[2] an anatomist and physician of the highest accomplishment of whom I have spoken more than once (p. 137). He lived in the first third of the fourth century, and was the author also of the first book on anatomy. Of these works nothing is directly extant, but we know that they were of great authority in their day, and largely used by the later botanists and pharmacists; as by Theophrastus, Apollodorus, and Crateuas. Theophrastus mentions him in the Περὶ λίθων where he is said to have described the urinary calculus of the lynx, a stone supposed to be so hard that a seal could be engraved upon it, and to have electric properties like amber. We may regard Diocles then, whose therapeutical treatises by the way were but a fraction of his great and various studies, as the father, in Europe, of the "soft arts of pharmacy."

The great botanical treatise of *Theophrastus* (370–287) entitled the *Inquiry into Plants* is happily extant,[3] and contains incidentally not a little medicine, and much vegetable poison lore. But Theophrastus, as a botanist, had of course nothing to do with animal venoms; indeed in his description of plants he was not directly concerned with their medicinal and pathological qualities, and said comparatively little on the subject. Consequently the treatise had little influence upon pharmaceutical writers, save as containing vegetable drugs and their origins. The great value of his work for us lies in other directions; still its indirect value must have been great, as Theophrastus had a wide knowledge of plants beyond Greece and the Levant. Sir Arthur Hort (Περὶ φυτ. iv. 4. 13, also 5-7 and 8-10) says that Alexander's scientific staff had collected such Eastern plants as cotton, banyans, pepper, cinnamon, myrrh, frankincense. Although, as a department of Natural History, the study of plants had been pursued long before the time of Theophrastus, he may be called the first botanist on rational methods. Thus again the exact and judicial habit of the Greek mind, conspicuous in the Hippocratic school and in Theophrastus, and on the whole continued in Nicander and Dioscorides, kept the very corruptible stream of pharmacy fairly clear until Byzantine times (see Xenocrates, p. 382).

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[1] See Pliny, iv., ix., xxv. 2, and Wellmann, "Das älteste Kräuterbuch der Griechen," in the *Festgabe Susemihl*.

[2] See Wellmann's *Fragmentsammlung d. G. A.*; and Schneider, on Nicander's *Theriaca*.

[3] Now well edited and translated by Sir Arthur Hort, in the Loeb Series, 1916. See notice by the present writer, *Class. Rev.*, Feb. 1918, p. 36.

As the foundation of treatment we have seen that Erasistratus in Alexandria laid stress on accurate diagnosis of disease and appreciation of individual "diathesis" (Galen v. 138). Though he concerned himself much with therapeutics he is not known to have written a special treatise on pharmacy; indeed, as we have seen (p. 154), he founded a new and alternative school of remedial treatment; a school of which Asclepiades was an ardent missionary in Rome, as was also Hikesius in Smyrna. Hikesius did write a book on diet and drugs which had considerable vogue, and took a place in the pharmaceutical tradition through Sextius, Pliny, and onwards. Of the Erasistratean school, as contrasted with the Herophilean, however, the main doctrine and practice lay rather in the sphere of physical methods —of diet, exercises, baths, massage, and so forth (p. 184), and but little in the pharmacy. Erasistratus indeed opposed the abuse of opium—"succus papaveris" (Pliny, *N.H.* xx. 18), and scoffed at theriacs. It seems pretty certain that in scoffing at those physicians who mixed up together in their prescriptions metals, plants, matters taken from poisonous animals, and from under earth and sea, he was barking at his colleague Herophilus. No doubt the collections of Aristotle and the discoveries in India of Alexander the Great and his "scientific staff" found their way promptly to Alexandria. Such "pharmaca," says Scribonius Largus (*De comp. med.* Introd.), Herophilus accepted as *munera divina*. Celsus says indeed that Herophilus believed there was no disease without its specific remedy (also Pliny, *N.H.* xxvi. 26). By the returning tide of polypharmacy in the succession of Herophilus, unfortunately encouraged in Rome by Galen, who obtained the prescriptions of Herophilus through Mantias and Heracleides of Tarentum,[1] rational, natural, and physical means, and even the memory of them, fell into disuse, or vanished. The gallant attempt of Erasistratus and his disciple Asclepiades to stem the muddy tide, and to warrant original Hippocratic hygienic principles, was but partly successful. Pliny says that Erasistratus drew much of his method from one Diagoras of Cyprus, and other writers of the fourth and third centuries B.C.; but Mantias followed obsequiously in the creed that for every disease a drug existed and must be sought for. Heracleides of Tarentum, as we have seen (pp. 168 and 370), turned more and more to the Empirics.

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[1] In Aetius the following prescription for night-blindness is attributed, we must hope untruly, to Herophilus: crocodile's dung, misu (copperas ?), hyena's gall, and honey, and to eat while fasting the liver of a he-goat. Galen says that Herophilus did his own dispensing, as we have seen in other cases.

About the time of Erasistratus (about 300 B.C.) flourished a certain *Apollodorus*, physician and naturalist, known from his study of poisons and venoms, as the "Iolog," and as the "father of iology." His first book was entitled *On Stinging and Biting Animals* (Περὶ βλητῶν καὶ δακετῶν).[1] Apollodorus wrote on *Deadly Poisons* (Περὶ θανασίμων or δηλητηρίων φαρμάκων and also treatises, or a treatise, on salves (Περὶ μύρων), and on chaplets (Περὶ στεφανῶν). He was censured by Erasistratus for introducing certain magical substances into pharmacy. We shall see that Dioscorides, who in the botanical part of his subject was indebted rather to Crateuas and so to the *Rhizotomicon* of Diocles, was for iology directly indebted also to Apollodorus. For Nicander he was probably the chief direct source, as also for Sostratus, Heracleides of Tarentum, Sextius, Archigenes, and many others.

Andreas, of Carystus in Euboea (*c.* 245–222 B.C.), of the school of Herophilus, was physician to Ptolemy Philopator, and with his master was slain by an assassin. In the earlier period of toxicology he was a considerable authority, and a source for those who came after him; now to the historian he is but a shadow, for unfortunately nothing of his writings remains but titles and a few scraps. He wrote, and may have been the first to write, on Rabies (see p. 342), and accordingly was called κυνόλυσσος (Cael. Aur. *De ac. m.*). We know that he was freely used by later writers of repute, such as Serapion and Heracleides of Tarentum, down to the first century B.C.; after this time he seems to have fallen into some neglect. It is curious that he in particular should have been accused of plagiarism. He was praised by Dioscorides but rather crabbed by Galen.

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[1] The title is sometimes given as *Περὶ θηρίων*. See Athenaeus, xv. and Pliny, *H.N.* xxii. Pliny, Sostratus, and Archigenes drew freely from it.

Nicander, of Colophon, described by Suidas as "grammarian, poet, and physician" (see Cic. *De orat.* i. 69), was a person of much consideration. The dates of his life are uncertain, but probably he lived in the time of Attalus III. (Philometor); in the first half, or middle, of the second century (died *c.* 132 B.C.). At Clarus near Ephesus he held the office of hereditary priest of Apollo and, as the oracles of Clarus were pronounced in verse, Nicander was thus an hereditary poet. O. Schneider says indeed he was more in repute as a poet than as a physician. Among other various works, including *Prognostics*, he wrote, in 958 hexameters, a *Theriaca* (On venomous bites and stings of animals) with the *Pharmaca*, or antidotes against venom. He wrote also, in 630 more,[1] an *Alexipharmaca* (antidotes against other poisons in food or drink, a book founded upon Apollodorus). Nicander described many venomous animals, and taught the labourer how to avoid serpents, or, failing these precautions, to use topical and other antidotes against their venom, and against that of spiders—then and afterwards supposed to be virulent insects (p. 354)—and scorpions. A french translation of Nicander, illustrated by fifty-five figures, by Grévin a distinguished medical humanist of Paris, and bitter disputant in the great antimony strife of the sixteenth century,[2] was published by Plantin in 1567–68, under the title of *Deux livres des venins ensemble des œuvres de Nicandre*, a beautiful book in two vols. sm. 4to, dedicated to Queen Elizabeth. It contains many woodcuts of plants and animals; *e.g.* asps, vipers, the basilisk, Pharaoh's rat, sea dragon, mad dog, etc. Grévin in short was to Nicander what Matthioli was to Dioscorides. After Grévin's death Jeremy Martius published a latin translation of Grévin (Plantin, 1671) containing also much other matter collected by Grévin, as well as Grévin's own counterblast against antimony. The fragments of Nicander's *Theriaca* with greek scholia and a latin translation were edited by that great grammarian J. G.

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[1] Both now translated into german by Brenning, *Berl. allg. med. Zent.-Zeitung*, 1904.

[2] This quarrel lasted for a century or more and flourished in abusive school disputations, in wagon-loads of books, and in public proclamations. On Aug. 3, 1566, the Faculty of Medicine of Paris pronounced antimony a poison, to be classed with "venins": "stibium deleterium esse et inter ea simplicia quae venenata pollent, numerandum." For others it was a precious remedy. Gervinus, Paracelsus, and Launay were ringleaders in the fray.

Schneider, Lipsiae, 1792–1816. This is the edition I have used. The volume contains also one of those excellent indexes which make the editions of these earlier scholars so valuable, and notes which are useful as well as textual. Indeed the omniscient Bentley deigned to publish some notes on Nicander's *Theriaca.*[1] Thus in Renaissance times was the wide repute of Nicander maintained. Haeser opines that Nicander's verses are by no means contemptible; Plutarch that there is no poetry in them, save the rhythm. I think, for exercises of the kind, they run smoothly, and the plant names are ingeniously woven in. Not only so, but I find in them still some interesting points, and a fair biology for the period in which they were written. Haller describes the first poem as "longa, incondita, et nullius fidei farrago," and on the second he is little less severe; [2] but Haller was a very superior person.

No doubt handbooks were then composed in verse, as again in later generations—*e.g.* by Nero's physician Andromachus, by Serenus Samonicus, by Fallopius and so on — to aid the memory. Which of us has not been indebted to school doggerels for our memory of names, dates, and rules? Professor Gilbert Murray says that, even under the Roman Empire when books copied by slaves were not very costly, the more studious pupils were still in the habit of committing to memory vast lengths of ancient authors.

Where in Nicander and Apollodorus we find similar materials are we to say that such passages were taken directly from Apollodorus? Both often correspond with Theophrastus; but, regard being had to textual variations, Nicander evidently did not copy Theophrastus; more probably he used some intermediate author, though he may well have drawn from the earlier sources used by Theophrastus.

Haeser tells us that Nicander was the first author to mention the use of leeches in medicine, and Neuburger repeats this; but Haeser must have meant the first in Europe (see India, p. 358). Others of his works had a great repute among the ancients; but, save for such portions as were gathered by later authors as spoils from a rich quarry—spoils too often unacknowledged, they are lost. Apparently they contained some but no great adulteration of magic. The *Theriaca* was largely reproduced by Sostratus (*c.* 20 B.C.),[1] and thence again its contents found their way to the Augustan Aemilius Macer, whose work probably contained, and handed on, much popular medicine.[2] The great work of Dioscorides owed much to Nicander; not directly perhaps but, as we shall see presently (p. 377), through the intermediate work of Sextius Niger. Evidently still the works of Nicander were highly esteemed, and had therefore a great and permanent influence upon therapeutical tradition from his own day down to the sixteenth century; an influence greater than is usually supposed. As he seems to have written about a score of volumes on various subjects his influence would be the wider; indeed he has been regarded as an encyclopedist, like Celsus, rather than as a professional physician.

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[1] *Mus. Crit.* Camb., 1814. The Diss. Phil. Vindob. vi., by Hermannus Klaus, *De dicendi genere* in Nicander's *Ther. et Alexiph.* is, I find, entirely philological. The Ed. Pr. was an Aldine of 1499 together with Dioscorides; an early recognition at least of their saleable value.

[2] Haller, *Bibl. Bot.* (Zürich, 1771–72), i. 54.

One of the more important pharmacists of the earlier time was *Crateuas*,[3] who was attached to the Court of Mithridates VI. (Eupator) (120–63 B.C.) and to this king dedicated a botanico-pharmacological work entitled *Rhizotomikon*, the title of the first Herbal, by Diocles. Fragments only survive, in Dioscorides, Pliny, Galen, and certain commentators. From Dioscorides and Galen it would seem that Crateuas wrote also another book which is now lost, though it seems to have survived till the second century A.D., when both were superseded by the great work of Dioscorides, and in later times by the popular Herbals of the Renaissance, such as the *Ortus sanitatis* and the *Grete Herball* of 1526. In this work Dioscorides speaks of that of Crateuas, and of Andreas also, as more complete than other pharmaceutical treatises had been. It is notable that Dioscorides speaks of Crateuas as a rhizotomist, of Andreas as a physician (see p. 363). The *Rhizotomikon* (the Culling of Simples) is interesting not only as a record of early pharmacy and iology but also as containing descriptions of plants previously unknown, as introducing metallic drugs, apparently for the first time, into Greece, and as illustrated by beautiful pictures of plants, pictures which are still extant.

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[1] See Galen xiv. 184.

[2] Macer wrote also on Birds (Ovid, *Trist.* iv. 1043); but a scrap or two only remains. The works current in modern times under this name and of M. Floridus, though probably all spurious, entered largely into the fifteenth-century herbals. The work of Sextus Placitus (date fourth century), more worthless still, and full of grotesque remedies, became likewise a source of Anglo-saxon medicine. It was translated into english more than once.

[3] For this notice of Crateuas I have to acknowledge some debt to the Essay by Wellmann in the *Abh'n. d. Kön. Gesellsch. d. Wiss. zu Göttingen, Phil.-Hist. Klasse.* N. Folg. ii. No. 1.

In the Hofbibliothek in Vienna is a MS. compilation, of about the end of the fifth century, known as the *Codex Constantinopolitanus*—a magnificent MS. on vellum; this was written for one Juliana Anicia, a daughter of the Emperor Olybrius. It contains some fragments of Crateuas, Dioscorides, and Galen, but especially these well-preserved illustrations, beautifully and naturally executed; some of these may be, probably are, those of Crateuas himself,[1] for Pliny says, "pinxere [*i.e.* C. and others] namque effigies herbarum" (*N.H.* xxv. 8).[2] The original Dioscorides was not illustrated, nor was Sextius, nor Pliny. They are quite modern in appearance, the detail and habit of the plant and the foreshortening of the leaves being remarkably natural. Mrs. Arber, who does not mention Crateuas, says that the MS. was brought from Constantinople by Busbecq. It was in the possession of a Jew who got 100 ducats for it. It was lent to Matthioli for use in his *Commentaries on Dioscorides*.[3] Among the excerpts from Crateuas in the Constantinople Codex are some which, in Wellmann's opinion founded upon identifications of certain plants, prove the use of the rich collections of Crateuas by Dioscorides; as indeed Pliny bears witness. In like manner no doubt Crateuas had been indebted to the *Rhizotomikon* of Diocles (see Wellmann, *Hermes*, xxiv. 530). The scribe, where he found himself short of space, seems to have omitted parts of Crateuas; how much of the defalcation was in Dioscorides it is hard to say, Sextius Niger being a readier source.

In connexion with the *Constantinopolitanus* it seems convenient here to mention another illustrated MS. on vellum, of the same kind, also in Vienna. The text likewise is a compilation—of Dioscorides, Philumenus, Philagrius, Oribasius, etc. As in the former so in this MS. the text itself is as inferior as is too often the case in illustrated books. But in this example the coloured drawings, of which there are more than 400, are far inferior to those in the Constantinopolitan. It is known as the Neapolitan, as it was procured from the Augustinian monastery of St. John Carbonarius. This also may be a less skilful copy of Crateuas. The old drawings, stiffened under the hands of the copyists into ruder and ruder conventions, found their way into the later MSS. of Dioscorides and others. The illustrations in Apuleius' *Platonicus*, a compilation from Pliny and Dioscorides of the fifth, or fourth century, the first to which the name *Liber herbalis* was applied, contains such figures;[1] and they did their unprofitable service until the renewal of plant illustration in the beautiful and natural figures of Braunfels and Fuchs in the sixteenth century.

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[1] A facsimile of it, which I have seen and perused, was published in 1906. Two of the illustrations are reproduced in Mrs. Arber's interesting book on *Herbals*, Camb., 1912. One or two of them were reproduced in Dodoens also.

[2] In his plural ("pinxere") Pliny (xx. 214) included Crateuas, Dionysius (the particular D. known (Pliny xx. 214) as Cassius D. of Utica, an unimportant compiler of a herbal, about 40 B.C., of which a few extracts only remain, and Metrodorus the pharmacist, author of an illustrated epitome of plant-collecting (*ῥιζοτομουμένων*) (not the M. who was a disciple of Chrysippus and teacher of Erasistratus mentioned on p. 142). In Galen's time these cullers had become servants of the physicians; sometimes their competitors; but many of them were botanists not concerned with medicine. See Fuchs (in Puschmann), and Galen xiii. 368, and xiv. 30 K.

[3] For an example of the tracing back of these and such drawings from age to age, as from a ninth-century Arab MS. to the Greek originals, see Bonnet, *Janus*, 1909.

Pliny distinguishes three classes of early medico-botanical writings: those in which the plant is portrayed; those in which it and its virtues are described, as in Dioscorides; and, thirdly, lists in which they are merely named. In the first class he places the writings of Crateuas, Dionysius, and Metrodorus; Crateuas being the oldest of these, and the initiator, in this subject, of combining figures with descriptions; unless possibly Diocles were before him (p. 361). In many MSS. of Dioscorides, it is true, figures are found, but in these examples the illustrations, even if of traditional origin, were inserted by later editors; nevertheless they may have come from the same original, and this, Wellmann surmises, was one or other of the earlier books, the books of Crateuas, Cassius Dionysius, or Metrodorus, the two last of whom certainly copied Crateuas; and of these, for reasons which he gives in detail, he points pretty surely to that of Crateuas.[2] Thenceforward, on the invention of copper and wood engraving, these figures of plants, which are really beautiful of their kind, were multiplied in later books; as *e.g.* in Peter Uffenbach's german translation of Dioscorides published at Frankfort in 1610.[1] The spurious letter of "Hypocrates to Crateuas" (Littré ix. 342), in which the writer begs for plants—for saps and solutions in glass vessels, flowers, and leaves in closer earthen jars—is interesting as showing that at the time this letter was written, and probably in earlier times, the physicians, with their assistants, prepared their own drugs in the surgery (*ἰατρεῖον*) from materials collected by the rhizotomist, who in earlier times was not a physician but one of a hereditary guild, which kept its own secrets. Pliny rebukes "the naughtie nature & peevish disposition of those persons who will not teach others their skill, as if themselves should loose for ever that which they imparted unto their neighbour" (*N.H.* cxxv. *On Simples;* tr. Holland).

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[1] Printed in Rome in the fifteenth century with crude drawings (Arber). J. F. Payne told me he thought they were derived from late Roman art. On the plates of plants antidotal to bites or stings the offensive animal is also depicted, as in other examples of these herbals.

[2] On the survival of certain illustrations supposed to be of Soranus, see p. 219.

Sextius Niger, who wrote his *Materia Medica* (Περὶ ὕλης) about fifty years after our era, occupies a somewhat central place in respect of the pharmaceutical tradition, both before him and after him. Save for the laudatory notice by Pliny, who helped himself freely from his pages, nothing is known of him personally. It is very interesting to trace out, as Wellmann ably helps us to do, his selection of sources, and his legacy to those authors who followed him. As we perceive, when we note certain differences in substance, opinion, or expression, Niger did not take his matter altogether from Nicander on the one hand, nor on the other transmit it directly to Dioscorides, who also sought some of his materials from the earlier writings—as from Crateuas, Diocles and, in some degree, from Theophrastus. For a considerable part of his work no doubt Sextius was indebted to Nicander; but he used his appropriations in an independent way, and controlled them by other authorities. Thus Niger did not fail to betake himself to original sources; for some materials even to the Hippocratic writings, to Philistion of Locroi (p. 135) the master of Eudoxus and a link with Plato, to Chrysippus the master of Erasistratus (p. 138), with more therapeutical profit, to Ophion, an Alexandrian physician a little the senior of Erasistratus, to Erasistratus and the other Alexandrians,[2] and again, in one place (ch. i.) distinctly, to their disciple Hikesius of Smyrna (p. 162). For iology he was beholden to Apollodorus, and so forward through Crateuas, Nicander, and Asclepiades. Sextius thus became the channel through which Dioscorides obtained materials from Theophrastus, though these may possibly have come to him through Crateuas; the differences in detail forbid us to suppose that Dioscorides used Theophrastus directly. Dioscorides had tried to arrange plants on a natural system, but Sextius, making some advance upon the alphabetical order and popular names of Crateuas, used a rough classing by external features.

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[1] This book seems to be inaccessible; it is not in our library, nor in the Brit. Museum.

[2] It is said that occasionally recipes of Erasistratus are still picked up here and there, as from the later Methodist writers. See Fuchs, *Hermes*, xxix. S. 171 and xxxiii. S. 342.

Of *Heracleides of Tarentum* (early first century B.C.) I have often spoken, as one who stands out as of great ascendancy in ancient medicine (p. 210), yet of whose life and works we know almost nothing. We know he was a pupil of Hikesius and a fellow-student of the pharmacist Apollonius Mys, and that, amidst his other studies in medicine, he devoted some time to iology. Galen says that he wrote on *Theriacs*, and *Venomous Animals*. Like the others of his time, he took these materials from Apollodorus. Although of more sceptical bent, he was of the Herophilean tradition, and so far disposed to polypharmacy; for instance, both he and Serapion, also a Herophilist, prescribed camel's brain and gall, crocodile's dung, the blood of tortoises, and so forth. In considerable part however, if not altogether, he went over towards the Empirics; and, although he drew upon the work of his predecessors, as we all must do, we learn from Galen that he used his materials with sagacity and discretion. From certain errors in quotation we infer that Celsus and Pliny knew his work only at second hand; thus they quote Heracleides on Rabies, a malady which was not discerned as specific till a generation later, in the time of Asclepiades.

It is said that Athenaeus of Naucratis, who wrote before Varro but after Hikesius, took the medical portion of his encyclopedic compilation, for which he drew upon something like seven hundred authors, from the *Symposium* of Heracleides. It contains quotations from Hippocrates, Philistion, Diocles, Praxagoras, Minesitheus, Erasistratus, Hikesius, and many others. Hikesius may have been the common source for Asclepiades and Niger.[1]

In the *De medicina* of Celsus there is a plenty of pharmacy and this of a rational kind; but as a therapeutical specialist Celsus took no place in the line of tradition which I am now following.

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[1] Wellmann, *Hermes*, xxxv., 1900.

One of the more eminent and more meritorious pharmacists of the early Empire was *Scribonius Largus*, probably a freedman ("civis Romanus"), perhaps a Greek who took the name of his patron. His collection of recipes, dedicated to Claudius under the title of *Compositiones medicae*—in the words of his first editor Ruellius[1] "thesaurus verius quam liber"—seems to have been written between the years A.D. 43 and 48; at any rate he was then living. Probably he wrote other books now lost. Whatever his origin, Scribonius, if we may judge from his occasional phrase of "ut Graeci dicunt," probably wrote originally in latin. Lists of recipes are never very amusing, and the author's style is meagre, dry, monotonous, and, as Helmreich says, beset with barbarisms; still we gain the impression that for his time he was a high-minded man, of sound judgement, very keen in his search for new and effective remedies, and one who has hardly received full recognition from historians. Haeser does him some justice. He was the first to mention opium as an extract. He insists on the importance of diet. He seems to have belonged to the sect of the Empirics, but was probably eclectic. Some credence he gave indeed to the mystic virtues of the number 3 and its multiples, and to sympathetic magic; and some of his remedies, such as liver from a dead gladiator, are foolish, others are superstitious; yet on the whole these blots, having regard to the traditions under which he lived, are relatively few and pardonable. In two places, as Schonack points out, he disapproves a remedy because it is superstitious. A "transcriptive relater" he was no doubt, but no mere copyist. His apparent debt to Nicander, considerable as it seems, is probably to be explained by the debt of both to a common source (see p. 365); for between the versions of such recipes as are substantially common to the two writers are many variations. If he borrowed any large section directly and literally from Nicander it was that on snake-bite; but Nicander in many parts—*e.g.* concerning symptoms—is fuller than Scribonius.[2] I have remarked that in comparing ancient authors in respect of plagiarism we are apt to forget the persistency in their days of oral tradition (p. 274). Writing undermined this kind of tribal memory, but slowly; a large common property in literary wares accumulated: of himself he says *ab aliis accepi* (copied from books ?) *sed raro*. Books, if cheaper, were relatively scarce, and reading was not a common accomplishment. Scribonius confesses that, in his earnest quest for remedies, he had gleaned from every likely person he had come across, including wise women. Galen and Pliny say that many of the recipes of Scribonius were taken from Niceratus, who was a disciple of Asclepiades; as also was Bassus the friend of Sextius Niger (Pliny, *N.H.* xxxii. 101). Wellmann[1] remarks on Favilla—"muliercula quaedam ex Africa"—who had a fashionable practice in Rome under Tiberius, that she brought many recipes with her which were adopted by Scribonius; these Wellmann cannot identify, but he says the extant texts are very defective. Scribonius may have written two books, but one only survives (p. 384). Or, like Theodore Priscian, he may have written first in Greek and then translated some part into Latin. Many persons, mere names to us, whom he mentions as sources of his material, were probably shrewd "general practitioners" of his acquaintance; a few, it is true, were authors of note. Besides, Scribonius seems to have travelled widely, and brought many drugs home from afar. He followed in the expedition of Claudius to Britain, but probably not as physician in attendance on the Emperor, or surely he would have said so. Among his prescriptions is a marvellous remedy for "Breast-pain." It was made in a secret chamber and, to deceive attendants and others, many needless ingredients were added to it. I suggest that this precious medicine was for angina pectoris. After the author's death the recipe came into the possession of Tiberius, and thence into the public libraries (Lucian, *Tragopod.* 270).

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[1] "Nunc primum tineis et blattis ereptus." The title is somewhat variously given by the several editors and commentators. Galen does no more than refer to him. The best text, so far as I know, is Helmreich's, Lips., 1887.

[2] In this short account of Scribonius Largus I am in part indebted to the critical study of this author by W. Schonack, Jena, 1912; also to P. Jourdan, "Scrib. L." *Rev. d. Phil.* xlii., 1918.

An interesting feature of Scribonius' collection—which is arranged not according to the natural kingdoms of ingredients but on the popular and handy system of *De capite ad calcem*—is the large proportion in it of surgical recipes. And, like Hippocrates and Celsus, Scribonius insists upon the due place of surgery, not as a separate practice, a twin, or annex, of medicine, but as an integral and progressive part of it, and not outside the sphere of the complete physician. Andromachus owed much to Scribonius; and in the fifth century Marcellus of Bordeaux (p. 384) in his *De medicamentis* used him word for word, though under the belief that he was copying from Celsus. For a philological study of Scribonius Largus see Jourdan (*loc. cit.*).

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[1] Wellmann, "Gesch. d. Med. in Alt'm," *Hermes*, 1912, Bd. 47.

Amid all the ancient writers on pharmacy *Pedanius Dioscorides* of Anazarba in Cilicia, of the school of Tarsus, scientist rather than physician, stands pre-eminent from Nero and Vespasian to the Renaissance.[1] And on the whole his eminence is well deserved. Dioscorides belonged to the Dogmatic sect, and so postulated the four humours; but he was by no means a rigid partisan, and had strong leanings to the Empirics; again and again he lays stress on experience. It is true no doubt that, as Wellmann says,[2] he was largely, chiefly perhaps, a compiler, a compiler who made little or no acknowledgement of his annexations; but, even so, the breadth and completeness of his treatise on *Materia Medica*—vegetable, animal, and mineral—(Περὶ ὕλης ἰατρικῆς) which contains both pharmaceutical botany and iology, written, as certain allusions suggest, about 77 A.D., make for it a great place in history, and testify to the ability and industry of its author. The *Materia Medica* was indeed a "precipitation" of all foregoing knowledge of the subject from Plato to Nero. It deals with the preparation, storage, genuineness, use, doses, and effects of simple drugs, and of their combinations. The author dealt with a large mass of materials, and arranged them in an original way; in the careful selection of facts, and freedom from superstitions, he surpassed all the old pharmacists, and criticised their works in a temper we may almost call scientific; indeed he was so far accurate in his language that most of his descriptions, slight as they are, are verifiable to-day; or so it is said, perhaps with some pardonable indulgence.[1] It is hard, for instance, to accept the enthusiastic testimony of some botanists, such as Tournefort (*c.* 1700 A.D.) who declared that when travelling in the Levant he was able to recognise at once a number of the plants described in Dioscorides which from the text alone he had been unable to identify. However, modern observers have to admit that really a considerable number of his descriptions are indefinite and superficial. As regards plant names, many no doubt were taken, whether by the author or his forerunners, from the rhizotomists; some names we find in Attic, others in the vernacular (*κοινή*), and so on. Some of them have survived to our own times. Crateuas, like Dioscorides, a native of Asia Minor, had brought names from the East, and turned some of them into the "common" Greek, in which form they found their way by Sextius into Rome. Thus it was that some plants passed under various names, and Galen says that one Pamphilus, a Greek grammarian and physician of the end of the first century A.D., drew up lists of plants to aid in identifications.[2] It is remarkable that papyri, so far, have given us no help in this popular subject. One difficulty in the older writers is their carelessness, and often no doubt ignorance, of geographical botany;[3] although on this side of the subject Diocles had made some small beginning. It is not always borne in mind that the treatise of Dioscorides was not of Botany but of *Materia Medica*, and so contained only some 500 plants. Theophrastus and Pliny mention perhaps twice as many. Notwithstanding, botanists assure us that the work of Dioscorides has been of great value to their science; as a medical handbook it is used to this day in the East, as, until the sixteenth century, it was in the West. Consequently, as Wellmann tells us, the treatise in its MSS. and many editions, complete and incomplete, several and composite, and likewise that *On Simples*, became extensively interpolated and falsified.

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[1] By the "Britannicum" of Cassiodorus and Isidore (iv. 10. 4) is probably meant Dioscorides. (See Probst, *Arch. f. Gesch. Med.* viii. i., 1914.)

[2] Concerning Dioscorides, again I am in part indebted to Wellmann. And, as during the war I was unable to obtain his edition of Dioscorides, I have to thank for the loan of it, as of other scarce books, my late Oxford colleague, William Osler, whose rich library was always "et amicorum." The MSS. of Dioscorides, complete and incomplete, are innumerable; so are the translations into many languages. The chief latin translation was that of Ruellius (Stephens 1516), which passed through many editions. Choulant says the rendering of Matthioli—a humanist physician of Siena, and afterwards of Rome, and an accomplished scholar—which accompanied his *Commentaries* (Venet. 1554), varied but little from Ruellius. Many of the editions of Ruellius and Matthioli were illustrated by excellent woodcuts, the source of which is not mentioned; some evidently came from Cornarius. The most beautiful example is of 1565 in the King's Library at Dresden; the "cuts are heightened with silver" (Choulant, and Mrs. Arber's *Herbals*, pp. 186, 192). In the copy in our University Library (Ven. 1560) many of the woodcuts are tinted in colour by a later but still early hand. Gesner, the contemporary of Matthioli, published a *Commentary of Dioscorides* in completion of the edition of Ruellius. It passed through many editions, but some of Gesner's own drawings were not published till after his death. The *Commentary* of J. and P. Constant, apothecaries of Poitiers (1628), is said to be very thorough and useful; I have not seen it. (On Wellmann's edition see p. 376. Of the amenities of sixteenth-century scholarship we have specimens in the Matthioli of 1560, in his tract against Amatus Lusitanicus, a Portuguese physician of wide travel and experience, in the margins of which are Matthioli's controversial points; such as: "A. L. mendax" . . . "A. L. in suo laqueo captus" . . . "impudenter" and "mendacio notatur"; and so on; and all this about a kind of cucumber—apparently not a cool variety. "Il semble que les hommes de cette période s'injuriaient pour le plaisir"—for the fun of the thing. See also Moule, "Zoothérap. de Dioscorides," *Paris méd.*, 1918, xxviii. Suppl. 240.

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[1] For the difficulties of such identifications and the meagreness of descriptions, see Hort's ed. of Theophrastus in the Loeb Library.

[2] Of two or three persons of this name certain relics have descended to us. The name Pamphilus was a common one. The Pamphilus who wrote the *Herbal* was a little later than the literary man who was a source of Aelian; but they may have been contemporaries in Alexandria. There was also a Pamphilus an "*unguentarius*." Aelian's *Natural History* is a literary man's show, and of no interest to the student of Medicine. See Galen xix. 64 K. and Wellmann, *Hermes*, Bd. li. 4.

[3] See Thistleton-Dyer, *Journ. of Philol.* xxxiv. 290-362.

The precise date of the birth of Dioscorides is not known, although it has been much discussed in respect of Pliny; in respect, that is, of the debt of either to the other. Dioscorides was of the school of Tarsus in Cilicia, and afterwards of Alexandria. Later he travelled in Italy as a military doctor. His travels were no doubt of much service to him, as they were to many other medical authors who served in the army; but he mentions only the district of the Abruzzi. On internal evidence the treatise *On Simples* may be placed about the middle of the first century A.D., *i.e.* in the time of Dioscorides, and probably was written before the *Materia Medica.*[1] His chief work, an inexhaustible mine of botany, medicine, and folk-lore which later writers have been quick to peg out, seems to have been written about A.D. 77, that is before the *Natural History* of Pliny;[2] it is far more sober and critical in temper and contents, and is free from fads and superstitions. Pliny (*e.g. Hist. Nat.* xxviii.-xxx.) is indeed the chief source for us of the records of the superstitions and magical remedies, which Sextius Niger and Dioscorides shunned. Oriental magic came into Rome later than the folklore of Greece, especially during the Parthian peace, and made way among the populace. Galen, drugger as he was, protested against this pollution, as he did against many but by no means all foolish and obscene remedies, such as gladiator's blood, human flesh, dungs of sorts, infant's brains, camel's brains (for epilepsy, as also hare's heart, seal's rennet, etc., etc.), and so forth. The well-known Ladanon—from Ledon, a kind of gum cistus—was said by Rufus of Ephesus to be obtained from the beards of goats which browsed on the rock rose, rather an odd than a foul physic. Xenocrates of Aphrodisias (p. 382), a superstitious busybody who lived, says Galen, " in the time of our grandfathers " (K. xi. 793), defiled the pages of his treatise on *Materia Medica* with heaps of perverse and filthy remedies.

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[1] This tract, written apparently before the *Materia Medica* (Wellmann), was edited in 1558 by J. E. Moibanus, a municipal medical officer in Augsburg, and a learned Grecian, especially in medical greek. He had found a MS. of it in Augsburg, and for his Ed. Pr. worked on nine more, hunting up all the fragments in Oribasius, Aetius, Paul, etc. The last edition, that of Max Wellmann, appeared at Berlin in 1914, "*Die Schrift des Dios. Περὶ ἁπλῶν φαρμάκων.*" Moibanus died in 1563, when Conrad Gesner completed his work under the title of *Εὐπόριστα Ped. Diosc.*, an. 1563.

[2] See Neuburger i. 326.

Wellmann's complete and scholarly, and probably final, editions of the text of Dioscorides and of the treatise *On Simples* (*Περὶ ἀπλῶν φαρμάκων*) were undertaken at the request of Wilamowitz, and the Scientific Society of Göttingen.[1] He was commissioned to search for MSS. in Germany, Italy, Austria, France, and Spain. The second volume was published first (in 1908), because of the value, in that portion, of the Parisinus, a leading MS. of the ninth century ; this source, which unfortunately is incomplete, Sprengel overlooked. Sprengel had done little more than reproduce, for Kühne's *Coll. Med. Graec.*, Sarazenus of Leyden's text of the *Περὶ ὕλης* ; and this not very carefully. Happily Sarazenus was a learned man, and deeply conversant with Dioscorides, as we may perceive in his Scholia and Appendix to the *Materia Medica*. He founded his text, and excellent latin translation, on the Moibanus-Gesner. The next best MS. is the Venetian. Twenty-nine MSS., some in the original order, others in the later alphabetical rearrangement, have been collated by Wellmann ; of these a critical survey is given and a very full list of *Variorum* (see p. 375 note). The first, but later, volume was published in 1907, and the concluding (third) volume of the text in 1914.[2] This contains also the remaining extant work of the author some fragments of Crateuas, and Niger, and valuable indexes.[3] The editor's restorations and emendations (so far as I dare express an opinion) are judicious; certainly they rest upon a vast acquaintance with Greek medical literature. A fourth volume is promised, to contain notes, translations, and a philological excursus by Wilamowitz.[4]

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[1] When these Lectures were delivered I had the advantage only of his article on Sextius Niger in *Hermes*, 1889.

[2] These technical treatises take a good deal of reading ; and this the more as the author's Greek is, as Galen says, laboured and inelegant. The reader will find a very useful crib in the German translation by Prof. Berends, Stuttgart, 1902.

[3] The Introduction to the reproduction of the Julia Anicia MS. is well worth reading, but the MS. text itself is of inferior authority. Concerning this MS. see under Crateuas, p. 367.

[4] W. has confirmed the genuineness of the Περὶ ἀπλῶν φ. in a full and methodical essay, *Die Schrift des Dioscorides Περὶ ἀπλῶν φαρμάκων von Max Wellmann.* Berlin, 1914.

How largely Dioscorides in both his treatises took his matter, often word for word, from his predecessors, especially from Crateuas and Sextius Niger, is proved by Wellmann, who, in his edition, quotes about 3000 "similia," or parallel passages, from earlier writers. In his prefaces, it is true, Dioscorides mentions a number of authors' names, but with no precision of reference, nor indeed with any definite note of direct obligation. We have no doubt to thank him for precious bits not only of Crateuas and Nicander, but also of Diocles and Niger; and scraps of Andreas, Heracleides, Bassus, etc. But too much must not be made of these unacknowledged excerpts, spoils of which but a few ancient writers, and these avowed compilers, such as Oribasius, were innocent. And, his spoils notwithstanding, we can claim for Dioscorides full consideration of merits which are his own, so that in his turn Dioscorides provided building materials for his successors. Galen has preserved for us (vol. xiii., etc.), a record, and some substantial fragments, of a work on *The Kinds of Drugs* by the great Eclectic Archigenes (p. 276), a work of high repute in its day; that is, in the time of Trajan, half a century after Dioscorides.[1] By comparison of passages it is found that in this treatise Archigenes was as much indebted to *The Simples* of Dioscorides, as he was also to the *Euporista* of Apollonius Mys, a late Herophilist, and a link in the chain of pharmacy from Herophilus to Galen. Although no author can be independent of his forerunners, loot should not be taken in the lump.

The rehandling of the *Materia Medica* on alphabetical order after the example of Crateuas, which we find had been perpetrated before Oribasius made his excerpts, was a clumsy device, for Dioscorides had endeavoured to systematise the materials of his subject; for instance, he classified remedies as Foods; as of Mineral, Vegetable, and Animal origin; as Drugs; and as Alcoholic. Moreover he grouped his agents as Astringent and Laxative, as Aphrodisiac and Anti-aphrodisiac; and so on. He supplied synonyms, provenance, and preparations. Theophrastus had already attempted a systematic classification by kinds, and was the first writer on plants to do so. The principle he received no doubt from Aristotle.

It was unfortunate, as regards the botanical parts of his writings, that Dioscorides had no direct acquaintance with the work of Theophrastus. Indirectly no doubt something, much probably, of Theophrastus had filtered down through Sextius Niger, who wrote in greek about 10–40 A.D.; still more of it came through Crateuas. From Crateuas, whom he frequently cites, Dioscorides, directly or indirectly, took more than from Sextius; but Sextius likewise had gathered much from Crateuas, and also from the Herophilean Andreas (220 B.C.). Many plant names in Dioscorides—some Attic, some κοινή—coincide with those of Crateuas; and again with those of Diocles, and yet again of Andreas. It is observed that both Dioscorides and Pliny contain errors in common with Sextius; the parallels also are many; and one subject had been otherwise mentioned by Sextius only. The story of the castor biting off his testicles to stop the hunters is in both Pliny and Dioscorides. The Narcissus in Sextius and in Theophrastus is *Leirion*, but in Philinus of Cos it is Crinon. Wellmann is annoyed with Dioscorides for heckling the authors whose stuff he was stealing without acknowledgement.

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[1] Wellmann, *loc. cit.* *Περὶ ἁπλῶν φαρμάκων.*

The iology, or most of it, came from Apollodorus (p. 363), as did that of Nicander, Sextius and Pliny, though probably indirectly through Crateuas; or perhaps through Sostratus, who wrote a little later. Of the lesser and for the most part perhaps sequacious writers to whose works Dioscorides resorted, many, such as his Empiric contemporary Zopyrus of Alexandria (*c.* 70 B.C.), are for us little more than names. Of Apollonius Mys—the fellow student of Heracleides, towards the end of the first century B.C.,—whose *Euporista* was of considerable authority in its day—Niceratus, mentioned by Galen, Menecrates, a pharmacist of the reign of Claudius and the inventor of diachylon, Bassus,[1] we know a little more. Bassus, who wrote in Rome under Tiberius, was a friend of Sextius Niger, and one of the sources of Scribonius Largus (p. 371). Sextius was a disciple of Asclepiades; but although Dioscorides mentions Asclepiades twice, his debt to him was apparently thus indirect only, through Sextius. The use of wine as a remedy almost marked an epoch (p. 329), and was discussed by Pliny as a burning question of the time. There was a younger Sextius, of whom we know little more than that Dioscorides drew largely from a prescription-book of his.

I have said that on the whole Sextius Niger and Dioscorides

[1] See *Hermes*, xxiv. 546.

eschewed the obscene and magical remedies so popular in their day; yet Dioscorides cannot be acquitted altogether of credulity and indiscrimination. As Sir Thomas Browne says, "not all that he delivereth therein is to be conceived miraculous"; but *e.g.* in recommending cinquefoil for the milder degrees of malarious fever, he advises the three-leaved sort for tertians, and the four-leaved for quartans; and if three crushed spiders be worn in a bag about the neck the efficacy is the greater. The most popular remedy for ague was verbena root, and pepper in large quantities (p. 337). Moreover, for Dioscorides, as for many other pharmacists, every remedy seems to have been a panacea. For instance, on opening a page by chance, we read that wine with pitch is warming, digestive, cleansing, and purging (*ἀνακαθαρτικός* means purging upwards, *i.e.* by vomiting); it is good for the pains of the parts about the chest, belly, liver, spleen, and womb, if without fever; and for chronic rheums and ulcerations of the lower parts. It does good also for coughs, slow digestion, flatulency, and asthmas; for sprains too, especially if laid on with greasy wool (*οἰσυπηρῶν ἐρίων*)[1]; thus as a universal healer the remedy throws Berkeley's tar-water into the shade.

> And give a dose for everie disease
> In prescripts long and tedious recipes
> All for so leane reward of art and me.[2]

Besides the *Materia Medica*, and the tract *On Simples* which was dedicated to his friend Andromachus, Nero's physician, himself an author of a work on Pharmacy, other treatises were attributed to Dioscorides, but in error; of these the chief are a treatise on Poisons (Περὶ δηλητηρίων φαρμάκων), and one on Venoms (Περὶ ἰοβόλων), known now as of a Pseudo-Dioscorides. Both in style and argument they are wretched compilations; moreover they differ from the *Materia Medica*, and seem to be of later date, probably of the seventh to eighth century (see p. 382, Philumenos). Neither is alluded to by Galen, Oribasius, or Aetius. A book of the third or fourth century on *Common Medicines* (*Εὐπόριστα*) also has passed under his name. Not only to make false attributions but also to write treatises under the forged names of big men, as for instance of Dioscorides, Aristotle, Soranus, Galen, and so forth and under such hackneyed titles as I have quoted, was no uncommon device in the early and middle ages. We have seen, moreover, that in the genuine treatise in the course of its long popularity and translation into many tongues, interpolations were made, especially in the time between Galen and Oribasius, when it was recast on alphabetical lines (p. 377).

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[1] Lanoline (*oesypum*) was in those days known as an ointment, and was in use down to the Middle Ages.

[2] Bp. Joseph Hall, sometime of Emmanuel College (1574–1636), *Sat.* iii. 4.

Dioscorides' claims so full a consideration because about this stem, backwards and forwards, we gather a long tradition. A cardinal phase of it was the still closer integration of his matter, by Galen, with the Hippocratic humoral pathology—*i.e.* of the four elements and humours. Thus, while Dioscorides used the same title as Sextius Niger, the larger title of Galen's treatise, in which he was indebted to Dioscorides, is *On the crasis and potency of simples* (*Περὶ κράσεως καὶ δυνάμεως τῶν ἁπλῶν φαρμάκων*, Galen xi. 794 K.). Although Galen drew freely from Dioscorides he never mentions him. It is fair to add that Galen did not concern himself much with the characters of drugs; and, as we have seen, his habit was to mention not those he copied but those he attacked.

The excerpts of Oribasius from Dioscorides' records of vegetable, animal, and mineral drugs are extensive. Gargilius Martialis (third century) also used him freely[1] and, for the modern commentator, helpfully. Aetius (sixth century), Alexander of Tralles (sixth century), Paul (sixth to seventh century), and the Byzantine encyclopedist Simon Seth (eleventh century) carried on the tradition more or less directly. Apparently he was not used by Serenus Samonicus (third century), Marcellus Empiricus (fifth century), Cassius Felix (sixth century), or Theodore Priscian (fifth to sixth century). Martialis was an able and learned man; he made a latin translation of Dioscorides, or parts of him, as of *De herbis femineis*, which reached later compilers, such as Isidore of the seventh century (chapters vii.-xi.). Rose (*Hermes*, viii. 38 A) commented on the preface to the latin translation, which, he said, had illustrations, and was edited by one Marcellinus; this probably was the edition introduced to the Benedictines by Cassiodorus, whose books, in their turn, are said to have formed the nucleus of the Bobbio library.[1] Parts of Martial's writings current in the gothic period (sixth century) lie ready to hand in the second volume of Rose's *Anecdota*. A good latin translation in five Books, full of Róman and Barbarian expressions (as *e.g.* in a ninth-century MS. now at Munich Hof-Bibl.), which reached Salerno, was still in use by professors in Florence in the sixteenth century, and so passed on to modern times. Other latin translations were made in and after the fifth century, all liable to interpolations: *e.g.* of the latin pseudo-Apuleius[2] *De herbis* (fifth century), a large part is taken from Dioscorides and Pliny. Parts of another latin translation of "Dyascorides," made in the later Middle Ages, found their way into the *Speculum naturale* of Vincent of Beauvais, who drew largely upon William of Conches, and thence into the *De prop. rerum* of Bart. Anglicus.

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[1] G. M.'s *Field and Garden Book* was a common source for the many compilers of natural history and therapeutics of the Middle Ages.

Dioscorides is found in polyglot versions—not in latin and greek only but also in gaulish, tuscan, dacian, egyptian, syrian, libyan, etc. (cf. Pamphilus and ps.-Apuleius *De herbis*)—many and various guises which have made his name famous, and the MSS. of his works of great philological as well as historical interest. The rude Latin verses are probably of far greater antiquity. Here I may allude to *Macer Floridus*, of uncertain medieval date, supposed by V. Rose to be a pen-name of one Otto, of Meudon on the Loire, a layman. He may have assumed this name in imitation, or in honour of Aemilius Macer, a contemporary of Virgil and Ovid, known to us only by the passage in the *Tristia*:

> Saepe suas volucres legit mihi grandior aevo,
> Quaeque nocet serpens, quae iuvat herba, Macer (iv. 10).

M. Floridus compiled 2269 unrhymed hexameters in 77 chapters *De viribus herbarum*, printed in the first part of the sixteenth century; and became a secondary source of much more second-hand ware of this kind as in the *Flos medicinae* and elsewhere, especially in Central Europe. The name "Macer" became almost a common title for a work on pharmacy as was that of "Aristotle" on Diseases of Women.

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[1] In the Vienna Library is now a combined MS. of Dioscorides (*Περὶ ὕλης ἰατρικῆς*) and of Galen's *Περὶ συνθέσεως φαρμάκων*; *i.e.* on the combination of "simples" (ἁπλᾶ) into compounds or "mixtures."

[3] Apuleius, commonly called A. Barbarus, is not fully identified. He may have been A. of Madaura, or A. Celsus, though probably neither. The Ed. Prin., Rome, N.D., was printed before 1484. My copy is of Ackermann's edition of 1788 (in his *Parabilium Med. Script. Ant.*), containing also Const. Afr. *De anim. lib.* and "Sextus Placitus" (p. 366 *n.* 2), *De med. ex anim.*, a good edition with notes. On the pseudo-Apuleius see Val. Rose, *Hermes*, viii. 39 ff.

How soon and how largely magic and occult abstrusities began to pollute Greco-Roman medicine we may see in the treatises *On Drugs*, and *On Animal Food*, of *Xenocrates* of Aphrodisias (at hand in Ideler i. 121), who wrote about A.D. 70. He hardly deserves mention, still less twice over, were it not that he seems to me to have been a leader in this reaction towards superstitious methods and remedies. There is no excuse for him, as in his day medicine was still in the main rational: but it was from his time that the stream began to be fouled. Galen, while adopting a few of his more rational recipes, and himself not dainty, protested against his filthy, occult, and magical remedies, and use of divination. Of his ingredients are scraps of all parts of animals, even of the human body; flesh, such as brain or liver; and even faeces. A list of such remedies, probably culled from Xenocrates, is to be found in Pliny (*N.H.* xxviii.-xxx.). It is said that references exist to some five works of Xenocrates. Through the traditions of the baser sort of authors this degraded pharmacy made its way into the writings of the weaker brethren even of the higher clinical physicians, such as Alexander of Tralles; and the prescriptions of Xenocrates were largely quoted down to the later Byzantine times when they found only too congenial a welcome. Even Paré prized his puppy fat. How perennially, even to the eve of the seventeenth century, the worse kind of Galenism prevailed may be illustrated by a letter of William Paule from Coucy, March 21, 1595 6 on the "illness of my lord ambassador" (Queen Elizabeth to Henry IV.). "The king's physicians gave him Confectio Alcarmas compounded of musk, amber, gold, pearl, and unicorn's horn, with pigeons applied to his side, and all other means that art could devise." (Sir H. Unton died a few days afterwards.)

Of *Philumenus*, once supposed to be of the first century, but now placed at a much later date, probably about the middle of the third, I have spoken before (p. 278). He seems to have risen a little above the crowd of Eclectic Methodists of the time, persons who to us are but names, yet may deserve a little more of posterity. However the chief interest of Philumenus for the historian is that he was a pond in the stream of the medicine of his time, especially in respect of gynaecology and toxicology;

a reservoir of material supplied from older authors, such as Archigenes, Soranus, and Herodotus, and a source for those who followed after, especially for the well-known Thirteenth Book of Aetius on Toxicology—one of the most valuable records in ancient medical history, and for Oribasius, Paul, and the pseudo-Dioscorides. The treatise of Philumenus on *Venomous Animals and their Remedies* (Περὶ ἰοβόλων ζώων καὶ τῶν ἐν αὐτοῖς βοηθημάτων) was edited by Wellmann in 1908 (Teubner, *Corp. Med. Graec.*) from a MS. which he discovered in the Vatican while searching among MSS. of the pseudo-Dioscorides. As a handbook to the many animals regarded as venomous this little edition of Philumenus is still useful to the historian. It may be that Oribasius did not himself collect from Archigenes, Apollonius Mys, Soranus, Theodorus (a pupil of Athenaeus), etc., but took the batch from Philumenus. So probably much more was copied (much of O. is lost), perhaps from Galen, Posidonius the younger—an Empiric who wrote on the Plague—Philagrius, and others. F. E. Kind (*Hermes* xliv.) has added to the parallel passages of Philumenus and Nicander.

Of the Empirical School was one *Aelius Promotus*, an Alexandrian, a man of mark only in the wooden sense of a signpost. He lived in the later part of the second century about the end of the reign of Hadrian,[1] a little after Galen and before Oribasius, and compiled a book called (in a MS. in Venice) the *Δυναμερον*, but entitled in a MS. in Leyden "Ἰατρικά, φυσικά, καὶ ἀντιπαθητικά"; in the words of Robert Fuchs "an aboundingly silly book." It was deeply infected by magic and superstition, but unfortunately was nevertheless used freely as a source by many subsequent writers. So Aelius himself (save as a corrupter of others) does not matter. But in the Vatican is a tract under his name entitled Περὶ ἰοβόλων καὶ δηλητηρίων φαρμάκων which (with the other work attributed to Aelius) has been analysed by Rohde [2] and shown to be taken from Archigenes, a discovery of no little interest (p. 276). From this treatise in part Aetius, Paul, and Theophanes Nonnus supplied themselves. Archigenes in his turn had taken some material from the "pseudo-Dioscorides," as he did from Dioscorides himself (p. 377), and so reached back to Niger and Crateuas. As Aetius and Philumenus drew from the same sources, these authors may be used for mutual correction.

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[1] See pars. on Ael. Pr. in the preface to Schneider's ed. of Dioscorides.

[2] Rohde, *Rhein. Mus.* Bd. xxviii. S. 268 ff., 1873.

Marcellus Empiricus, of Bordeaux, not a physician but a so-called "philiater," who lived and wrote during the reigns of Theodosius I.-II. in the later fourth and early fifth centuries A.D., although a crude and credulous compiler, and a dealer in pagan and Christian incantations, amulets and other magic, produced notwithstanding a household vade-mecum in some ways interesting though scientifically contemptible. From it may be retrieved some parts of the lost Ruellius MS. of Scribonius (p. 371) from whom he took much material. Philologically, in his latin tongue are seen the beginnings of the French language.[1] His writings, held in esteem for many generations, are important to the historian of manners. Furthermore, we find him urging his sons to use the benefits of science in human charity for all sick persons, even though they be the meanest of the poor, or strangers; for thus their labours will be more acceptable to God and more laudable among men.[2] And, however busy they may be, they must never be careless—"ne culpetur medicina cum peccarit incuria." If much of the handbook was taken from Scribonius, and much probably from an epitome of Pliny—but it is not easy amongst these pharmacists to say which was robber and which robbed—yet Marcellus also sought for prescriptions "among the rustics and the populace," and thus handed down many curious folk-remedies in the Gallo-Keltic tradition, and so forward to the *Rosa Anglica* and the *Lilium medicinae*; whence again they passed to Mirfield, and later authors. We possess one MS. of Marcellus only, at Laon (ed. Helmreich, Lips., 1889); a fine vellum copy of the ninth century, unfortunately imperfect.

It was among the merits of *Alexander of Tralles*, in the sixth century (p. 411), that, although he classified his remedies with much sophistical subtility as tonic, relaxing, thinning, thickening, drying, moistening, etc., etc., yet he was no extravagant drugger. He used the more natural means such as baths, exercises, and the like.[3] He used bleeding but said that it mattered not where one bled (p. 333). His works had a long and wide popularity and were translated into many languages, including arabic, syriac, and hebrew. Unfortunately soon after Galen's time drugging became more and more gross and mechanical. Drugs were drilled into columns under conventional heads; such as *Calefaciendi, Siccandi, Repellendi, Discutendi, Abstergendi, Contrahendi, Necandi*; and so forth: and excerpts from Dioscorides, etc., were boiled down into tables with cross references. Although under the name of Galen these practices of gross and often filthy drugging gained the upper hand so far as to foul the stream of therapeutic methods for many centuries, while from the fifth century baths and general hygiene fell into disuse almost till our own day, yet such is the irony of history, that Galen's treatise on the potency of ways of life (*Περὶ τροφῶν δυνάμεως*) was, so far as we know, the first special treatise on Natural Therapeutics.

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[1] See *Deutsche Literaturzeitung*, xxxiii., 1917, March 10.

[2] "Cujus scientiae beneficia vice mutua caritatis humanae cum omnibus infirmis, amicis, notis ignotisque; immo vero cum advenis magis et pauperculis communicare debetis, quia et Deo acceptior et homini laudabilior misericordia, quae aegro hospiti ac peregrino egenoque defertur" (Marcellus, Ded. to his Sons).

[3] We must be careful to avoid error in the sense of the word "*φυσικά*," as used for remedial means. It does not necessarily, nor generally, signify physiological remedies or

After Galen, *Aetius* (p. 409) was the most learned of all the many later writers on Poisons, and is a valuable source for the historians of toxicology (see Rohde, *Rhein. Mus. Phil.* Bd. xxviii. S. 268 ff.). He lived in the sixth century, was a student of Alexandria, and resided in Byzantium where—probably under Justinian—he held high office. His great compilation on Medicine has come down to us almost complete. Of this work the toxicological chapters are but a part, and are taken more or less, through Nicander, from Apollodorus; though much richer in content. For pharmacy he was indebted to Archigenes—probably through Philumenus, Oribasius, Scribonius Largus, and others; indeed he laid a very large number of his predecessors under contribution. One Aeschrion, an empiric of Pergamon, a teacher of Galen, seems to have been another of the chief sources of Aetius. In his turn he was a source for Alexander of Tralles and Paul; as also for Photius, Nonnus, and other voluminous compilers of the centuries down to the thirteenth, such as Nicholas Myrepsus and Alexandrinus, from whose long-winded recipes, many of them under handsome titles, such as *The Antidote of Helen Augusta*, *The Secrets of Master Alexis*, and so on, had a prodigious vogue; the greater because the popular collection of this Nicholas was

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methods taken from nature, as contrasted with *δίδακτα*—academic or expert methods. Indeed in the period we are dealing with the word had become so degraded as to signify magic, and folk-medicine, even as opposed to the therapeutics of the schools. It was in this sense that A. of T. brought *φυσικά* from his oriental home.

commonly confused with the small *Antidotarium* of Nicholas Praepositus of Salerno, a century his senior.[1] Of his sixteen books the first two deal with vegetable and mineral remedies; the thirteenth with iology and antidotes. The earliest modern Dictionary of Drugs was the *Clavis Sanationis* of Simone d. Cordo of Genoa (Simon Januensis, d. 1330) published at Padua in 1474. It was almost entirely galenical, and by its vogue did much to rivet the chain of polypharmacy upon Western Europe.

On the whole Aetius seems to have been a man of large experience and sound judgement, and to have made his borrowed materials his own. Like the rest of his kind, he was sadly deficient in critical faculty, yet is rather unduly depreciated by Wellmann. It is true that he was by no means free from the vice of the period, the canker of magical and fantastic remedies, and may thus have corrupted his otherwise respectable, and even more than respectable, contemporary Alexander of Tralles, whose really excellent medical writings were disfigured by such vanities.[2] However, Sextus Empiricus probably did far more to corrupt not Alexander only but all the medicine of that period. For example he recites the incantations on digging up herbs, such as henbane; ceremonies which grew apace in later centuries. Pliny tells us that in gathering a herb for a sick man, his name and his father's must be pronounced; a popular observance in Rome. Later came paternosters and litanies, carrying simples to the church, and the singing of masses over them; and so forth. For Aetius the excuse is made that he set forth this stuff in order to get beforehand with the quacks! The writings of Aetius have occupied many scholars, and a good early translation into latin was made by Cornarius; but a complete edition of the *Tetrabiblon* is one of the historical needs of the day.

The Fifth Book of *Paul of Aegina* (A.D. 600–650) (p. 413) is wholly devoted to pharmacy and poisons.[3] He was largely indebted to Aetius and Oribasius. He enumerates vegetable, animal, and mineral remedies, and antidotes to bites and stings. His works had a great run from the seventh century down to the Middle Ages. He describes the methods of sucking, cauterising, or excising poisoned wounds, much more fully described by Celsus long before. He attributes hydrophobia to the bite of a mad dog; and says that although in his experience none recovers from this malady, yet some may be saved before the outbreak of symptoms, by cauterising, and by the use of certain remedies taken from Dioscorides, Galen, and Oribasius, and of some medical plants not previously mentioned. He put the usual incubatory period at forty days, but as being sometimes much longer.

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[1] The points of MS. distinctions are given by Choulant, *Handbook*, pp. 156-7, 282-3.

[2] In searching for MSS. of Dioscorides, Wellmann has lighted upon one containing a "Dynameron" (a later title for treatises on pharmacy), which he attributes to A. of Tralles.

[3] A translation of Paul's treatise into german by Berendes is appearing by instalments in *Janus*. It is based on the Aldine of 1528 and the Basel edition of 1538.

I would remind the reader of Adams' translation of Paul, with a full and learned commentary, as I think it is not mentioned in Hort's Theophrastus.

To *Theodore Priscian*, an archiater of Gratian, one of whose chapters deals with pharmacy, I will make but an allusion; namely, to his doctrines as a combination of Methodism and Empiricism, and to the point that the Hippocratic tradition, even in Salerno (Gariopontus), had then become deeply tinctured with the opinions of these sects. Still Priscian did what he could to discourage elaborate dialectic, to simplify medical teaching, and to turn back to positive pathology and anatomy. He had a wide influence, as he wrote in both greek and latin; and has recently been edited by Th. Meyer. Ilberg criticises the editor's views on the romanising of Greek Medicine; but his commentary is good and his translation of the *Euporista* and *Physica* readable. Parallel literature is indicated in the notes.

With the third century A.D. the centre of gravity of civilisation passed to Byzantium; of its Medicine I may speak another day. Rome, once the great mistress, fell into a long degradation. Rhetoric, which always had its faults, began to wane in a fashion of laboured and quibbling dialectic and finical literary style without breadth of view or originality of thought. Occultists of all sorts swarmed in Rome, and the latin language decayed in an atrophy almost to extinction. However, upon the neo-latin tradition came the Syrian Jews and the Arabs, and medicine was planted out in Italy, Spain, Gaul, and even in Great Britain.

In these lectures, Sir, if I have failed—and with but our present resources we may hardly succeed—to bring the physicians of Rome out of chronological tables and to present them in living portraiture, yet, if, in any subordinate degree, I have made a fair endeavour to illustrate the inner movements, and to read the genius, of those variously gifted races of whom Roman medicine was engendered—the dreamy Sicilian, the positive and sagacious Greek, the subtle and demonic Oriental—which, blended in Sicily and Alexandria, inspired the motley players who walked the stage of our art and mystery at the feet of the imperious mistress of the world ; if in any fair measure I have done this, my labour and your long-suffering—for which I gratefully thank you—may have been not wholly in vain.

BYZANTINE MEDICINE: THE FINLAYSON MEMORIAL LECTURE[1]

Mr. Chairman, Ladies, and Gentlemen—We are gathered together to-day in memory of James Finlayson, a wise physician and a gentle scholar. More than once, with the art of the scholar and the love of the benefactor, he displayed to me some of the treasures of your library. I would that my lecture to-day were more worthy of him.

It was a fine saying of that great historian and physician, Charles Daremberg, that in the domain of mind, as in that of matter, we cannot believe in spontaneous generation. The springs of life and the development of life; its order in variety; its integrations of ever new and broader functions with the world around it; its compass and comprehension; these growing powers, these rich and manifold qualities have their lineage; they have their origin in the past; they have their ancestry, their laws of tradition, their channels of nurture: and if animal development cannot spring directly from the clay into highly wrought organs and various functions, neither likewise can the spiritual life. It, too, must have its lineage, its race; from parent to parent the social life is engendered and nurtured; from generation to generation it dwells upon its gradual houses, families, and tribes, and rejoices in its children; it learns to reflect upon its history in the past, and from that vantage to reach forth into its future, and to imagine its destiny. Societies have their pedigrees as men have; like men they may be true or false to them; they may make themselves greater than their fathers, or they may waste their patrimonies in sloth, perversity, or folly.

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[1] Delivered in the Faculty Hall on Friday, June 6, 1913. Reprinted from the *Glasgow Medical Journal*, November-December 1913.

Thus, when the Germans swarmed about Rome and broke or penetrated into the city, of themselves they were barren; they were as the formless clay of which I have spoken, out of which there can be no spontaneous generation. Rich the new soil may have been, rich as the ooze of the sea; but there was no past, no spiritual lineage, no political, no intellectual heritage; no ideas, no tradition, no law, or but rudiments of them. Even Theodoric's kingdom was not the framing of a new world; it was but an ark wrought out of the old timbers. Then the Franks, they again had built nothing, and therefore knew not yet how to build. The Merovingians' rule was a bare survival of decrepit forms of the Lower Empire; its rudimentary feudalism was for Rome alien and disintegrating. The Empire in its old form was perishing. The great landowners of Rome could no longer govern nor fight; unhappily, for the invaders were not without reverence for the old mother. But authority was waning; fighting was left to the fair-haired Celts from the north, and the rude Illyrian warriors; and misery and disease, more cruel than the conquerors, were corrupting the civic body. Thus what disorder and rapine had begun pestilence finished. Not only was the populace destitute—this was an old story—but, if I may use such a phrase, the "middle classes" also had fallen into misery. Out of the loins of the old body the New Rome on the Bosphorus and, by the Donation of Constantine, the Papacy, were born; but the period of gestation was dark and wild.

Let us turn back for a moment to an earlier period, to glance at the drift of the policy of the Empire in the first century. In the early Empire provincial government was more or less by consent, by much concession to local races, customs, and even governments; thus, with some contemptuous tolerance, Rome often ruled but nominally from the centre. She kept the peace without crushing local rule and privilege; but her constitution, under a change which had been progressing from Julian times, and was matured under Diocletian and later emperors, stiffened into a calcareous shell. As Dr. Reid[1] says, in place of an Augustus came a kind of Sultan wearing that oriental diadem, the mere dread of which had destined Caesar to his end; the Emperor was approached with adoration as a living god, and lawyers buttressed his throne with an absolutist theory of the constitution which was universally accepted. And by the material grandeur and might of Byzantium, which drew its sustenance from both east and west, this splendid despotism was strengthened and glorified. In the Hellenistic age then civilisation became more despotic but also more cosmopolitan. And it contained the fatal rot of the foundation on slavery and servile classes. Thus came the despising of all crafts; medicine by its separation from surgery, was eviscerated and starved; all education became sophistical and "classy," and in so far as it led to power in the State, was not for the masses. So Hellenism lost its spirit, education became artificial, narrow, and out of touch with life, and progress was set back, even to stagnation. It is a strange anomaly that as in the later Empire (on and from the third and fourth centuries) Medicine deteriorated, physicians, as Harnack has pointed out,[1] were many and held in higher and higher esteem. This esteem may have arisen in part from a deeper—Christian—humanity, more and more of them were Christians, but also from the lower motive, the fashion I have mentioned. of rising in society by casting aside handicrafts. Sir William Ramsay has illustrated this dignity of the physician by contemporary evidence (partly in conversation, but see also *Class. Rev.*, 1919, Nos. 1 and 2). He quotes a certain inscription to a physician of a family of rank in which Medicine was hereditary (cf. Hippocratids, Nicander, p. 364, etc.); also Basil of Caesarea (fourth century), who wrote a noble eulogy on the Medical profession (*Epist.* 180). Yet it was in this period of its history that Medicine was corrupted by charms, religious incantations, and relics, the prayers of hermits, and so forth. Not that the influence of the church was wholly obscurantist; it denounced charms and spells and magic, rebuked drunkenness, and forbade abortion at any rate after the fortieth day—the day of the entry of the soul, unless the life of the mother were in jeopardy.

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[1] J. S. Reid, *Cambridge Medieval Hist.*, vol. i.

As Europe then was, this transformation may have been inevitable; almost from the end of the Republic it had crept on steadily, degree by degree, as if implicit in the nature of things. Perhaps in no other way could the citadel of "culture" have been held against the vast and turbulent hordes which had yet to be tamed and moulded into modern civilisation ; in no other way perhaps could the soul of the ages have been saved. But the price was a heavy one ; the heirlooms of the past were carried into fortress, and for a millennium were immured in a sumptuous, almost a spell-bound treasure-house. The calcareous shell was of mother-of-pearl ; the walls and towers of the casket shone in the sun with such splendour as Jeremy Taylor conceived of the Kingdom of Heaven. Exalted in the wilderness of Europe, shining like a sun, radiant with gold and gems, pompous with priests and men of war, Byzantium guarded the precious germs of which a new world was in due time to be born. But meanwhile this very pomp which, to the hordes which beset it, made it seem invulnerable, stiffened the sinews of the defenders. In their serried regiment there was no play for personal freedom, no play for varieties of temperament or diversities of creed. As in our own great war, a rigid uniformity of array, an absolute subordination of rank to rank, an unbending orthodoxy of belief were the cement of the fortress, the conditions of its solidity and immunity, and the protection of its sacred store. We shall anticipate then that within its walls there would be no expansion, no breathing of the human spirit, but the immobility of a great rock ; the silent watch of its sentinels, the enslavement of the poor and the needy, and the bondage of the human mind.

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[1] Harnack, *Medicinisches aus d. alt. Kirchengesch.*, Leipzig, 1892; and Diepgen, *Münch. med. Wochensch.*, 1912, Nos. 43, 44, 45.

And what was this treasure, so jealously guarded ? Much in many ways ; but for our part to-day it was the records and forms of that spirit which we call Greek. In Greece this spirit became embodied, and in Attica culminated, in forms of beauty which have since commanded the admiration of the world. It is hardly unfair to sum up Byzantine medicine as a narrow drill in traditional aphorisms, partly clinical and Galenical partly quasi-Aristotelian, in meagre epitomes of older authors, and in lists of recipes. But, regarding this spirit in its full story, we find the mainland of Greece too narrow a sphere for its domain. We have but to think for a moment of the gifts of Ionia to the mind of man to perceive that this spirit animated a territory wider far than the land of Greece in the stricter sense. Even Apollo, our medical god, goes back through his Dorian days to his birth in Lycia. Aegean it is also called, yet even this name is not wide enough. You will be ready, I think without argument, to speak of it as Eastern Mediterranean. We find it in vivid life long before the palmy days of Athens, and on many an after age it shed its blessings. We find it in its elements in Crete, in its beauty in Homer; and we trace its shining steps in Arcadia, in Thrace, in Magna Graecia, in Latium, and in many another island and peninsula of this inland sea. The earliest Greek medical schools of which we have any record were at Rhodes, Cyrene, and Croton. Those of us who have visited the wonderful museum of the Villa Papa Giulio in Rome—in which, as we hear from Mrs. Strong, the collections have now been displayed in a larger room—marvel to see from Latium evidences so exquisite of this civilisation; in Latium which, in early Roman days, had become not only indifferent to Greek culture but actively hostile to it.

In my FitzPatrick Lectures I endeavoured to sketch the fortunes of Greek medicine in Rome, where its penetrative power expanded against all thwarting and contempt; in Rome, notwithstanding the blight on the medical tradition of Alexandria, Greek physicians did good and even brilliant work until, under Marcus Aurelius, medicine culminated in Galen. From that time, although jurisprudence kept its high place—for jurisprudence, though originally Greek, was established in Rome—medicine ceased to bloom or to fruit; the harvests of a thousand years were over, and for this art and science the Greek spirit sank into sleep and, but for one man's life perhaps—Alexander of Tralles and let us add, Aetius—lay dormant until towards the eleventh century. If Galen still had lip service it was rather for the more rhetorical and officious than for the sober and fruitful products of his genius as testified by his experimental physiology; moreover he was cherished by the Christian Church for his monotheism,[1] for his teleology, and for his generous and humane defence of the Christians.[2]

From the time of the elder Pliny—before it indeed as we know from Cato's *Commentary*—there had been in Rome a strong bent to mere recipe medicine; a semi-superstitious belief in strangely overloaded compounds such as mithridatics, theriacs, and other traditional blends of many drugs; and after Galen this cruder therapeutics almost drove out the intelligent hygienic methods of the school of Hippocrates, and of Alexandria as made known to us by Celsus. Thus, while the excellent Celsus was forgotten, not to be recovered until his exhumation in the fifteenth century by Thomas of Sarzana—Pope Nicholas the Fifth—receipt books, such as that of Scribonius Largus and its progeny, were cherished, and, as we shall see, provided the mediocre followers of Galen, such as Vindician, Marcellus Empiricus, Lucius Apuleius, Theodore Priscian, down to the two Nicholases, and other herb-gatherers and apothecaries—worthy men in their way, but really the forerunners of the herbalists and quacksalvers of later times —with the contents of their gallipots, and the columns of their antidotaria.

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[1] How nearly the Greeks approached to a lofty form of monotheism, see Dr. Gilbert Murray's new book, *Four Stages of Greek Religion*, p. 90.

[2] This well-known passage, although preserved only in Abulfeda, is accepted as genuine.

Medicine of any pretence to a scientific quality thus passed, as I have said, into slumber. The germ, in suspended animation, was enclosed in what nowadays we should call a huge and cumbrous somatic envelope. The great procession of medicine which, streaming from the fountain of Hippocratic times, received the Sicilian tradition of Pythagoras and Empedocles, the great tributary of Greek Alexandria, and the Greco-Roman medicine of Asclepiades, Soranus, Archigenes (Aretaeus), and Galen, passed into a chrysalis phase, and thus abode, we may almost say, until the revival of learning. Its feeble glimmers of life before that epoch could hardly be regarded as a new birth. Byzantine medicine then was not a living influence; it had become a tradition, a burial of the talents. The culture of the mistress of the world in this period was imitative, hoarding, and stereotyped; it created no masterpieces, scarcely indeed, unless in law, a spontaneous and original work in any kind.

The part then of Byzantium in European civilisation was almost wholly one of conservation, or embalmment; moreover so many of the texts are unedited, and even unexplored, that a full history of that period is as yet impossible. Not in science and art only, but in the withstanding of the ruin of the Western world, she stood not for progress, but for holding the fort; and this, partly by strength and wealth, partly by inflexible institutions, partly by prestige, she did to a marvel. Of original thought, thought which by dissent might have caused agitation or discord, there could be no sufferance. Yet the all-pervasive Greek spirit was not, could not be, wholly captive even in Constantinople and the Levant, where it still flowed in strange contrast with the officially maintained Latin tongue. In Asia already, under the successors of Alexander, it had penetrated far and wide; into Syria also, as we shall see; into Mesopotamia; into Persia; nay, even to Bokhara and the Ganges. It had made centres for itself in such schools as Edessa, Antioch, and Nisibis; and when, for daring to use his troublesome mind, Nestorius was driven out, at Edessa he rekindled this spirit; and, when expelled thence also, established, or re-established, in Persia the famous, and largely medical, school of Gondisapor. Thus, on the liberation of the literary treasures of Constantinople, Syrian, Jewish, and Arab scholars were ready to fan these embers into a fitful flame, and to restore to Europe its own again. It was in strange guise however that it returned; disguised in Syriac or Arabic translations of Greek manuscripts, and in renderings of these again into Latin: for on such maimed and vitiated counterfeits Europe was fain to subsist until the revival of Greek.

But the elder traditions had suffered more harm than that of waste and corruption. They had gathered moss and blight which had eaten into their life; the intellectual and pellucid Greek conceptions had mingled for good and harm with Oriental phantasies of which presently I shall have more to say.

For before we fix our attention upon our own art, and on the Faculty here represented by the great College before which I stand, in order that we may comprehend the conditions of its theory and practice, let me try to sketch in, however slightly, some background of the philosophy and science of the Empire, and especially of the eastern part of it. In the West of Europe, until the rise of the Carolingian and Irish schools, learning had sunk almost into oblivion. With Tacitus and Lucan Roman literature had declined; romance literature was far from its dawn. We have seen that if in the Eastern Mediterranean Greece as a political power had also declined, yet the mission of Hellenism was far from spent. The truth is, Greece never had a great political capacity. Even Pericles was rather an idealist than a statesman. Comparisons between one state and another, or between one people and another, can seldom run far; but there is not a little likeness between Greece in ancient and France in modern Europe. Modern France, purged by fire and awed by calamity, is born again; and if we look at this great people in the light of history we shall see in them much of the Greek attitude to life; a like temper, a like mission. In them we shall find the same artistic gift, the love of harmony of form—of ἰσότης, that untranslatable word signifying free balance, artistic, social, and ethical, the ardour and even prophetic passion for general ideas, the devotion to logical symmetry, to mathematics and the physical sciences; but therewith the like instability of political institutions. And in both nations we see like perils in the defects of their qualities; a tendency to exalt form over substance, a desire to think in categories, a surrender to rhetoric, and, in public affairs, a kindred fickleness and turbulence. As France has had, and has still before her, her mission in the West, so likewise had Greece in the East. By their own sacrifice these peoples have inspired the nations of the earth.[1]

But with the bias of the Empire eastwards, before the establishment of its eastern seat, I have said that other leavens no less potent were at work; leavens working from the farther East. In part from Egypt, in part from Persia, in part from Mesopotamia, in part from Ionia and Syria, flowed into the Roman Empire streams of thought and passion, many of which would have seemed alien to Europe had they not been greedily absorbed by it. As Greece took her captor captive, so she herself failed to save the Empire from the darker witchcraft of the Orient, of Asia, and of Roman Egypt. Even in the third century B.C. the Aesculapian worship, which then was carried from Greece to the Tiber, was gathering into itself elements more and more Oriental; as lustrations purged the soul so the gods were turned to healing the body also; Aesculapius melted into Serapis, Hygieia, Salus, Soter. Thus the positive medicine of the Hippocratic tradition, which had resisted such superstitions, began to blend with the cults of the Dea Mater from Phrygia, of Isis and Serapis from Egypt, of Mithra from Persia, of Syrian Baalism; cults brought in partly by the subtle waves of the spiritual atmosphere, in part more directly by sophists, slaves, freedmen, and, as it is recorded, by certain peripatetic missionaries of the foreign and mystical creeds. But more than this, more corrupting than all of these—for it may be said that the strange cults, each or many of them, held some aspect of truth—more malign than all was the enticement of magic, always the black shadow of mysticism and, like gambling in the material sphere, the betrayer of human endeavour. Long before the invasion of the obscurantist cults to which I have alluded, and apparently independent of the Mysteries properly so called, the taint of magic was ingrained in ancient Roman and Etruscan societies.[1] It is true that in Aegean history, in times long before the Roman and even before the Athenian civilisations,[2] signs of Oriental influences and Oriental origins are apparent enough. Still, on the whole, these elements were then but elements; in the later Empire they had swollen into an equal or more than equal place with cults and ideas more originally European and, as we think, saner and wiser.

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[1] I am thankful now, in the summer of 1919, to read again these words delivered before the Great War. I desire to blot only one clause of it; to write for "fickleness and turbulence," fortitude, gallantry, and prowess.

Thus Byzantium, the rampart of Western civilisation, herself became half Oriental; and so forward in time this intimate diffusion of oriental ideas into roman and hellenic thought, the blend of hellenism with orientalism, persisted far beyond Byzantine times, down indeed to our own day; the thought of the Middle Ages it almost dominated, so that some historians take the accession of Constantine as the opening of the Middle Ages. Perhaps the first formal step into Eastern manners was the assumption of divinity by Alexander the Great, whose ominous example was followed much later, perhaps inevitably, by Diocletian and the emperors who succeeded him; indeed we may date "Byzantinism" roughly from the time of this Emperor (A.D. 284–305). If the Christian emperors of Constantinople were not worshipped quite as gods, they were adored as royal pontiffs, whereby a theocracy and a hierarchy were established which, in spite of the later separation of Emperor and Pontiff, created and perpetuated the boundless and perpetual idea of the Holy Roman Empire. Deification of Emperors, Popes, and Kaisers was then no mere bubble; it was a superstitious sanction more or less necessary for a larger social cohesion. Cohesion first; individual freedom afterwards, as may be. This kind of absolutism grew with the first oriental emperor—the Syrian Severus, and the presence of Easterns in the Senate.

We know that it is otiose to speculate on the march of history whether as good or evil; our duty is to try to understand it as it was: nevertheless the presumption is that only by this iron rule of divine or semi-divine institutions, by an iron rule which of necessity enthralled the very souls of the people, could the great rampart have been raised against the barbarians and against Islam. It was to foster the rudiments of civilisation that this iron nursery was constructed, and enamelled with gems; an awful outward symbol of strength and glory. Lest it should be anything less than whole and united, intolerance of dissent was inevitable; it was perhaps necessary that the Nestorians, and even Chrysostom himself, should be cast out; that the opinions of all men should be hammered into solid uniformity, with such consequences for science, literature, and medicine as we shall see presently. For, contrary as it was to Christ's teaching, religious institutions, whatever their content, their tension, or their furtherance of holiness, have in their purport and function always become political, and nowhere more so than in the long story of the Roman Empire, ancient and medieval; heresies were persecuted not as religious but as political perils. Unfortunately in this, as in too many other periods in the world's history, this machinery, when it had served its purpose, was not scrapped in due time, but endured; to the stifling of young ideas, and the bondage of young limbs.

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[1] See FitzPatrick Lect. p. 27, etc.

[2] And even in primitive Greece; see Dr. Halliday's recent book on *Greek Divination*, 1913. Of Witches and Pythonesses in Merovingian Times, and of Gregory of Tours Belief in Divination, see Prou, *La Gaule mérovingienne*, p. 185.

How majestic in its prime was the Byzantine machine is now well known to the general reader. By the work of Findlay and Freeman, and since them of many writers such as Bury, Miller, and Frederic Harrison, we have learned that Byzantium reached a standard of civilisation far higher than any other state of the Middle Ages, and that the conditions of life there attained a security before unknown in the world. We have learned that in its noon Byzantium was by no means in all respects inert and decadent. It was the mother of great statesmen and great soldiers, and a centralised bureaucracy and a despotic court and army which alone could have held together and defended so heterogeneous a populace. Moreover, whatsoever the cost, order was maintained; and, as well as the art of war, jurisprudence attained the high development to which the Institutes of Justinian, the last great Latin act, bear witness. But lawyers are rarely reformers; as in Bunyan's dream, Legalism and Formalism walk hand in hand.

However, law was by no means the only Byzantine achievement; to last a thousand years a state must have had certain great virtues. If science and literature were sterile and imitative, producing no masterpiece, yet in the fine arts Byzantium had a sublimity of her own; and in history and philosophy she was at least copious. During her best centuries—that is to say, before the crisis of her decadence in the seventh century, before in the sixth century Justinian closed the schools of Athens and Alexandria, and before in the seventh Leo the Isaurian closed the Academy of Constantinople—in architecture Byzantium had constructed the dome, and built Santa Sophia; she had developed also the art of mosaic, lofty and austere; when we call it crude and harsh we are perhaps thinking of the "restored" mosaics in S. Maria Maggiore or St. Mark's, and forgetting the visions of Ravenna, in monumental beauty surely comparable with the Elgin marbles. And, if in painting Byzantine artists were arid and jejune, we know that in the arts of enamelling and metal work, and in ivory carving, these craftsmen excelled, and moreover made a tradition. Again, the great hymns which Ambrose carried to the Western Church were composed in the Eastern; many of them, it may be, under the inspiration of Chrysostom.

Of the historians of this period we have all heard of Procopius, of Agathias, of Nicephorus and his accomplished wife Anna Comnena, and of Niketas; but there were more of them, not mere chroniclers, but respectable if not brilliant authors. In the later centuries of the city, when in the ninth the schools had been reopened under Theophilus and Photius, Basil the First and the Comneni, authors of some greater merit arose, such as Photius himself, Suidas the lexicographer, and Psellus also, who, motley and undiscriminating as he was, yet, as an encyclopaedist, was a man of vast learning, and the reviver of Platonism. In the latter part of the eleventh, and in the twelfth century, the renaissance gave still brighter promise until, by the savage feudal violence of the Crusaders, heaps of manuscripts were destroyed, and all culture was thrown back into confusion; however I am now straying beyond the limits of my subject.

But in all ages the course of medicine has been governed by the contemporary philosophy; and when we turn from war and the arts to the science and philosophy of Constantinople we find ourselves before a vast and manifold syncretism of stoicism, epicureanism, empiricism, and scepticism; the empiricism and scepticism, according to a law of the human mind, being, as in our own day, shadowed by mysticism. This mystic ingredient was made up of neopythagoreanism, neoplatonism, gnosticism, and similar "high imaginations." Before Christ, we meet with this kind of brain-spinning in certain gnostics, and in Philo Judaeus also, who, moved by the Old Testament and Talmudic tradition, made a near approach towards the Christian standpoint. In Augustine's opinion, all pagan philosophies might be pillaged by the believer, as was the Egyptian gold and silver by the Israelites. Thus, later, on the Bosphorus old mystery cults blended with new religions, with folk-lore and superstitions, allegory and symbol, in all of which demonism took a large place; so that even in the Christian religion, then and long afterwards, exorcists and incantation formed, if not an essential, at least a considerable and formal ingredient.

Demonism, then and since, in byzantine, papal, and modern times, entered deeply into the conceptions of East and West, and closely attached itself to Medicine; its pallid reflection we may perceive even yet as the "morbid entities" emanating from distinguished physicians in our midst. In the great time of ancient Greece, it is true, we find allusions to Socratic and other demons, allusions not left unimproved by later scholiasts. But those demons were not the devils of later times, they were divine, or quasi-divine, spirits or essences;[1] or they signified only possession by the god (*ἔνθεοι*) as in the Corybants, or again in dramatic passages as in that of the *Knights*, crying that *δαιμονῶντες* they would overthrow the city. For us the classical passage is that of Hippocrates, the words probably those of Hippocrates himself, words familiar to us all but which I cannot forbear to repeat, concerning the Sacred Disease, the seizures of which were attributed to the god: "But to me," he says, "it seems that all diseases are divine in origin, and that no malady is more divine or more human than another, but that each has its own nature, and does not arise without natural causes." To personify disease is a somewhat different conception, and comes nearer to our "morbid entities," as when Hesiod says that some diseases by day, and some by night, stalk abroad *αὐτόματοι*—

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[1] Δαίμων in those days did not imply evil; *e.g.* the daemon of Socrates, the souls of the dead inhabiting the air, and so on.

self-willing and self-moving—bringing evils to mortal men. In Homer we read, of course, of *μάντεις* and incantations (*e.g.* T 456). In the *Philoctetes* the medicine is terrestrial; but Plato (*Theaetetus*, 149 c, d) speaks of an *ἐπῳδός* against pain of childbirth. Thus we pass easily on to Mephitis, goddess of sulphur and foul smells; and the sending of a disease by a god expands into possession by the god, or by an evil spirit, especially in case of agonising and incomprehensible maladies such as epilepsy, or lunacy a name which speaks for itself. Thus, from the Olympians of Homer we pass to *numina*, from numen to nymph (nympholepsy), and so to evil spirits or devils; from the genial inspiration of Pan by easy steps to Artemis and Hecate. The old Pythagorean doctrine of agents of evil influences entering with the food, as with beans, belongs to the same ways of thought; and thus we may travel from Varro, Pliny and Tacitus to later writers. In the earlier times however we were dealing with little more than echoes; from the second century A.D. onwards, by eastern influences these ideas were enormously inflated. In the magical papyri, and in writings such as those of Alexander Aphrodisias, we find demonology in full blast.[1] The mild Olympian divinities, and the colourless *δαίμονες*, are degraded, after the Assyrio-Chaldean and medieval type, into a devil's troop, and medicine becomes a quasi-sacerdotal function—a scheme of exorcism. And we never lose that curious and universal superstition of the power of a name—that to know the name of a person or thing is to obtain a power over it, a notion far from extinct even in modern practice.

Origen speaks of *βιβλία βάρβαρα δαιμόνων ὀνόματα ἔχοντα καὶ τερατaίας*. Thus it was with the scarcely different belief in scripts and amulets, such as the *Ephesia grammata* of Plutarch.[2] The magic of music against evil spirits, a notion not without a true therapeutical basis, is familiar to us from the Old Testament; medicine which degenerated into a prescription of mere noise of the village, of warming-pans and andirons. And how certain metals, stones, or gems, or again parts of plants and animals, had magical power, how herbs were to be culled under ritual observance, is likewise a story familiar to all of us. In no author to my knowledge can these baser accretions be better studied than in the racy pages of that masterful father, Tertullian, whose works I was enticed to explore some years ago by Professor Harnack ; [1] and I am informed that evidence of the same kind is to be gleaned abundantly from Irenaeus, Tatian, and other fathers of the church. To Origen I have made some reference already. Accordingly the fathers of the church, or most of them, possessed by the philosophic ideas which I have mentioned, indignantly rejected material means of healing ; for to make use of such means was to deify earthly things. Even the dissection of animals was regarded as sorcery, and many physiological errors were defended as supports of theological doctrines. Medicine and religion were no longer as in ancient times independent. Why not go direct to God himself ? And the approach to God was, of course, through the Church and the Priest, whose remedies were laying on of hands (see FitzPatrick Lect. p. 32), prayer, and exorcism. Then, as now, fanaticism, whatsoever the good faith of the operators, beat back to lower orders of ideas.

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[1] This reference to Alexander I have not verified, but I suppose it is not to his Aristotelian Commentaries but to his treatises on the virtue of stones, etc., and to the *Περὶ δαιμόνων*.

[2] See Wendland's remarkable book, *Die hellenist.-röm. Kultur*, Tüb., 1907; also art. "Aberglaube" in Pauly-Wissowa; and Tambornini, *De antiq. daemonismo*. 1909.

But, while repudiating all healing methods akin to magic, we shall not forget at the same time to admire and commemorate the sublime devotion of our Christian forefathers, who—in the midst of manifold and malignant pestilences, one of the most terrible of which seems to have been anthrax, and the great plague of Justinian's reign which raged for fifty years (A.D. 531–580)—did not hesitate to devote their service, and too often their lives to the sick. And, to darken the horrors of the time of which I am speaking, the doom of the world was then impending ; men's eyes were fixed upon apocalyptic visions of a hoary wicked and devastated world, presently to perish in the crash of the Last Judgement. We shall not marvel then that even in the second century, and worse and worse in the third and onwards, superstition fermented upwards from the lower people to the more enlightened. Demonism is catching, and, like astrology also, or measles in Polynesia, fell upon an unprotected people.[2] The exorcist was divided, if at all, by a very fine line from the magician ; the priest and the magician being divided chiefly by the rivalries of status and privilege. Yet a few voices of wisdom were heard. Ulpian was unwilling to admit exorcists as legitimate practitioners, saying as follows: "Si incantavit, si inprecatus est, si, vulgari verbo inpostorum utar, exorcizavit, non sunt ista medicinae genera; tametsi sint qui hos sibi profuisse cum predicatione adfirmant."[1] And this refusal of earthly therapeutics was intensified by the teleology which, inherited from Galen, culminated perhaps in Jerome who, as a logical teleologist, said summarily: "Everything is created for mankind. If a creature is not wanted for food it must then be wanted for medicine"; and accordingly he gives a long list of animal preparations thus intended by God for the healing of men: of such are viper's flesh, the gall of hyena or eagle, dog's dung, goose fat, blackheaded maggots, and so forth; though by the way he gives in these paragraphs a very interesting and far more useful record of the foods of various nations. Thus the crudest teleological glosses became universal: the normal period of pregnancy, to correspond with the number of the Decalogue, must be ten months; the male child must be carried a shorter time than the female because Adam was born before Eve; and so on. I remember to have read somewhere in one of these fathers of the church that, as an illustration of the glory of creative power in the adaptation of means to ends, he described the anatomy of the nose of which, as he observed, the upper part is indeed hard and bony, but the lower moiety soft and cartilaginous so as to lend itself to the human fingers; a convenience which in the daintiness of modern manners may not at once be obvious to you. So we perceive that the evolutionary teleologists of our own day are but nibbling at the subject.

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[1] Harnack, *loc. cit.* When Christianity became the State religion it became narrower and harsher than paganism had been ; and was used to stifle medicine and all the sciences.

[2] See Prof. G. Murray's *Four Stages of Greek Religion.*

Well, in such times how was physical science getting on? With rare insight the ancient Ionian philosophers had fixed upon air and motion as the principles of biological function. I have elsewhere discussed (F.L. p. 259) what I have called "the pathetic search after oxygen"—pathetic because the modes of fire and "innate heat" could not but have remained for them a secret: their apprehensions were indeed sublime, but verifications unattainable. They apprehended that about the vital air there was some peculiar virtue, a virtue which they called spirit; and this spirit, or pneuma, Praxagoras put in the arteries, though unfortunately he, and later physiologists, left in these vessels no room for other ingredients. In my FitzPatrick Lectures I have dwelt almost too long upon the Pneuma,[1] but here I must at least remind you of another strain of thought—the Pythagorean which, reinforced by the genius of Empedocles, flowed from the Italo-Sicilian school, and, influencing Plato profoundly, did not leave even Aristotle unaffected. Thence numbers and harmony flowed into physiology, but accompanied by other transcendent and ethical notions, wrought an almost Pauline dualism between soul and body, and between the higher mind (φρένες, νοῦς) and the lower (θυμός). However, if Anaxagoras gave the conception of development on laws expressive of *nous* which inspired form, it was the Pythagoreans who practised the first investigations on the embryo. Alcmaeon dissected, and had displayed many of the minor parts of the body, such as the Eustachian tube; he had a glimpse of the origin of man by evolution from the lower animals by survival of the fittest, and spoke of the soul of plants. He also placed the soul in the brain, which Praxagoras perceived to be a development of the spinal cord; but this entity, from the day of Aristotle to that of the Abbess Hildegard, had wandered back to the heart again. Now all this pregnant beginning of the great positive medical tradition, which, in the following centuries, was verified and enlarged by the Hippocratic and Alexandrian schools, and brilliantly extended by Galen in the later Empire, was to fall back into the melting-pot, and to issue (as we have seen) in the murky and lurid doctrines of daemonism.

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[1] "If he has used incantations, or imprecations, or—to use a word common with these impostors—exorcisms, these are no sort of medicine; albeit there are those who loudly declare that such practices have done them good." Ulpian, *Dig.* L. XIII. c. i. § 3, quoted Harnack, *loc. cit.*

I need not say that what happened to anatomy and physiology did not fail to befall other sciences. Astronomy had to submit to the calendar. The Aristotelian cosmography was not the best which the Middle Ages might have accepted; it superseded the heliocentric system of Aristarchus and Hipparchus, who were greater men than Ptolemy. The church was almost bound to fulminate against any but a geocentric theory of the universe; and even the Aristotelian round ball of earth about which the fixed stars revolved in ethereal spheres had to shrink to the Syrian view of the earth as a disc encircled by the sea, and covered by a dome between it and Heaven. Psellus however, in the eleventh century, as I find in his *Quaestiones Naturales*, had got back to a spherical earth, and gave the sound old reasons for this opinion; moreover he asserted stoutly that the motions of the heavenly bodies "were not vital but physical." The long controversy concerning the antipodes is well known; almost all the fathers, as we see down to Augustine, Isidore, and Bede, were against them. Albert of Cologne however accepted them, and him Dante followed.

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[1] Πνεῦμα, as life and breath, signifies two functions of one thing, namely, the soul, *ipsa anima spiritus* (see Chap. X.). Mind, say more than one of the church fathers, is soul's work. Galen, though an Eclectic, was no little of a Pneumatist.

But a worse perversion than Aristotelian and pseudo-Aristotelian cosmography was *Astrology* (p. 54). This mischievous ally of magic came from Mesopotamia; it was heard of in Europe in the times of Alexander the Great, and is alluded to by Theophrastus; it penetrated into Rome under the Republic. Augustus gave some countenance to the fantasy, which was unfortunately adopted by the Stoics, although not only Horace and Juvenal, as is well known, but also many other authors, such as Sextus Empiricus, and even Pliny, opposed it. Ptolemy shaped it into a factitious science, and Frederick the Second played with it. Most of the church fathers, it is true, jealously denounced astrology: Tertullian, wrathfully, as polytheism. John of Salisbury assailed it: as, later, did Pascal and La Fontaine; until at last it was killed by Jonathan Swift.[1] The notion of transmutation of substances by a conversion of energy belonged in part to the Aristotelian division of form and substance; and from it issued the search for the transmuting agent. Plato had an idea of a relation of metals to the planets. The metals began to live and to have souls; each planet, if no longer a divinely animated and eternal being, was guided by deity (θεοὶ κινοῦντες) or spirit;[2] or, for the Christians, by the finger of its angel. The original substance was supposed in the East to be Mercury, but in Egypt it was Lead (Osiris); and it is curious to observe that, in our modern transmutation theory, lead is a late term of the radium series.

Thus by easy steps we turn to *chemistry*. Astrology merged into *Alchemy*, to be itself transfigured by Geber, the greatest of the Arabs, into the fertile science of chemistry, as we learn from the well-known treatise of Berthollet. The most cursory reader of illustrated books must have admired the imposing apparatus in the laboratories of the ancient alchemists, and the thick-headed wonder thereat of the medieval warrior.

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[1] See Appendix to my Harveian Oration of 1900.

[2] The quintessence (πεμπτὸν στοχεῖον) or fifth heavenly energy of Aristotle was imagined by Harvey to animate that wonderful planet, the heart (see my Harveian Oration for 1900, and FitzPatrick Lect. p. 318).

To come now to *Biology*; all through the Byzantine and Middle Ages in medicine Galen was practically the only, though the infallible and the immutable guide. On the gamut of the four elements and four humours could be played a number of tunes so infinite that further inquiry of Nature became needless. Thus the marvellous biological work of Aristotle and Theophrastus was forgotten or perverted; the *Physiologus*[1] and *Clavis* books, and fables and fantasies of biblical or rabbinical origin, took the place of observation; and Byzantine and medieval natural history, following too readily the example of Pliny, gave birth to the bestiaries and herbaries which, however quaint, curious, and naïve to the antiquary, are from the point of view of science—or, indeed, of any normal mental activity—deplorable. Grotesque as science, the world of griffins, salamanders, phoenixes, unicorns, and basilisks, of elephants without joints, and of pelicans with bleeding breasts, was hardly redeemed by much charm of imagination. These medleys of monstrous allegorical and magical lore reached their lowest point in the seventh century or earlier, though there is always a remnant; in this century that interesting but shadowy person, Bishop Nemesius of Emesa, held on more soundly to Hippocratic tradition. His *Περὶ φύσεως ἀνθρώπου* was translated early into Latin, and mostly used in the Middle Ages. It is a learned blend of Plato and Christianity, and not quite so interesting as I had anticipated. The Bishop was well acquainted with Hippocrates and Galen. He opposed astrology and fatalism on the principle that knowledge depends on investigation of Nature (and of revelation). His physiology and anatomy are half Aristotle, half Stoic (Posidonius). He placed the mind in the fore-brain. He held that organic evolution had progressed gradually, without any sharp line, from beasts to Man. But from the seventh century to the Latin revival under Charles the Great the recovery was tedious and slow.

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[1] Dating from the second century A.D.; summaries first written in Alexandrian Greek and interpreted in biblical senses; of these many translations into latin appeared in the Middle Ages.

And, during all this time, what was medicine doing? Well, at best medicine, in default of original or direct investigation, had entered likewise upon the period of conservation of which I have spoken. Although between Celsus and Oribasius arose many original observers and practitioners in medicine, more especially in its surgical aspects, yet Celsus, as the custodian of Alexandrian medicine—especially, perhaps, of the school of Philoxenus—may be said to mark the beginning of the conservative as contrasted with the progressive periods; as Oribasius presented conservation in its fullest and most creditable light. Although on the division of the Empire many Greeks returned homewards, Rome still retained her "prestige"; and in well-to-do philosophical and conservative circles medicine still won some honour.

Oribasius of Pergamum, one of the last savants of the Alexandrian schools, who lived during the latter part of the fourth century and was the personal physician of Julian, edited in seventy books a digest of medical and surgical works then extant; of these books only twenty-five remain. It is a compilation of course, but of its kind excellent; how excellent is discovered to us in the monumental edition of Daremberg and Bussemaker. For its sane and rational method, its learning and discernment, if not for literary art and concision, though far larger than the *De medicina*, it may, without injustice to Celsus, be compared with it. In its entirety the collection was far too unwieldy for ordinary uses, so Oribasius—moved thereto, it is said, for the education of his son—wrote a summary of the work —a *Synopsis*—which had only too perpetual a vogue. I say too perpetual, because it was the very popularity of these summaries and manuals, so abundant in the Byzantine and Middle Ages which, even more than fire and sack, threw the original works of the Romano-Greek physicians and surgeons into oblivion and destruction. Thus Oribasius was himself the indirect cause of the loss of the works of many of his revered predecessors. Notwithstanding, curtailed as are the works of Oribasius, they bear witness to the soundness and thoroughness of the medical education and tradition even of the later Greco-Alexandrian schools. As to its literary ethics, although in this respect his example was still neglected or ignored (F.L. p. 273), he himself, as honourably as accurately, "verified his references," and duly gave to each one of his authors what was his.

Of his predecessors thus laid under contribution I may name —I can do little more—a few. Of the most distinguished were Diocles, Erasistratus, Mnesitheus, Meges, Asclepiades, Athenaeus, Agathinus, Archigenes (chiefly known to us in the less ingenuous pages of Aretaeus), Herodotus, Heliodorus, Antyllus, Philagrius and Posidonius, and many others whose names may be unfamiliar to some of my hearers, but whom we may take as among the chief of our Greek medical forefathers; some of them, such as Diocles, Erasistratus, and Rufus, men of the great times whose every relic is precious.

And the later men embalmed by Oribasius should be more than names to us: they were not mere encyclopedists. In surgery especially Heliodorus, Herodotus, Antyllus, Philagrius and Posidonius, to mention but a few, had made great advances. Antyllus, as I have urged elsewhere in an argument for the integration of medicine and surgery, was distinguished as a physician also. He wrote on hygiene and therapeutics from the Methodist point of view. We gather from Oribasius that he was the first to describe aneurysm, and he operated on it by the double ligature; Philagrius, nearly one hundred years later, proposed extirpation. Antyllus not only describes tracheotomy —this had been done long before (F.L. p. 211)—but gives good clinical rules for the practice of it, and for its use or omission. He operated on benignant tumours and hydatids, on glands, and on the urinary organs. According to Razes he extracted for cataract, and he performed plastic operations. Heliodorus, under Trajan, advised torsion of vessels and operations for stricture, scrotal hernia, and resection of bone; and he performed amputations on an improved method. Thus it seems that hernia was for a moment taken more or less out of the hands of the peripatetic craftsmen, though in later centuries we hear only too much of these ruffians.[1] Leonides, about ninety years after Galen, also operated for hernia; he tied and obliterated piles, and operated even on goitre. The two brothers Philagrius and Posidonius (under Valens) improved operation for stone. Of all these masters, not a few endowed with talents or even genius, we have but scraps and glimpses. Yet from them, as I have declared on a former occasion,[1] we may trace the history of some antiseptic surgery through Salerno to the great Italo-French surgeons—through Roger, Hugh of Lucca, Theodoric, Lanfranc, William of Salicet, Guy of Chauliac, to Paré. And in this place I would not fail to include *Publius Vegetius*, who flourished about the latter half of the fourth century. He has always interested me because, as a veterinarian, he was perhaps the founder of the study of comparative pathology; the study which, as I said in my Address on Medicine in this city in 1888, is yet to come, to lift us out of a Ptolemaic or anthropocentric into a Copernican or universal medicine.

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[1] See Dr. Ferrari's interesting study *Une Chaire de médicine au XV^{e} siècle*, Paris, 1899, pp. 141 *et seq.* and in this vol. p. 475; and many other records, *e.g.* Mondeville *passim*. Montaigne in his travels, after a very interesting story of his visit to Felix Platter at Basel, witnessed such an operation for a hernia on a young girl, and remarks upon the roughness of the procedure. See also Allbutt, *Hist. Relations of Med. and Surgery*, 1905.

Meanwhile those influences of the East that we have denounced were making more and more way into Rome and Byzantium. The Empress Julia Domna, a "charming and versatile woman," a Syrian of Emesa, wife of Septimius Severus and mother of Caracalla, for whom she was regent, had a "salon" at Rome. Galen frequented it, as did also Ulpian, Diogenes Laertius, Philostratus, Aelian (Bouchier). She it was who set Philostratus to write the life of Apollonius of Tyana, and she did much towards "the crystallisation of the third-century vague neo-pythagorean mysticism."

In the sixth and seventh centuries, if we descend upon workers and compilers of less ability and scholarship, we may still be thankful to perceive that on the whole the physicians were comparatively free from the more superstitious corruptions; if infected by magical and fantastic influences they were not enthralled by them; yet such was their spell that even Alexander of Tralles,[2] who was almost as a man born out of due time, as it were out of the time of the greater Greeks, did not shake himself free from these enchantments.

With *Aetius*, of Amida (Diarbekr) in Mesopotamia, we begin with physicians of the Christian religion (p. 385); Paul of Aegina and Alexander of Tralles were Christians.[1] Aetius flourished about the middle of the sixth century in the reign of Justinian, and so about the same time as Cassiodorus and St. Columba. His collection is much scantier, and much less skilful, than that of Oribasius, and it is without his spice of personal judgement. With medical tradition are mingled Christian mysticism, pagan superstition, magic formulas, methodist dogma, and the blind and narrow faith in Galen which faces the historian all through the Middle Ages down to Molière. Still he is the most learned author on Medicine since Galen, and his Book xiii. on Toxicology is valuable for the historian. The work contains sixteen books, but is usually called the Tetrabiblion, because in the manuscripts it was customary so to divide it. It deals with remedies pharmaceutical and physical, with venesection, diet, and prognostics; then follow the several diseases, ending with gynaecology chiefly taken from Soranus, probably through Philumenus (F.L. p. 278). He is the first to mention turning in foot presentation, which seems not to have been practised again till by Arnold of Villanova and, in the thirteenth century, by the admirable Antonio Benivieni. He does not acknowledge his sources as did Oribasius, but his materials can be traced to Archigenes, a well-pillaged man, Galen (on fevers, lethargy, etc.), Oribasius, Herodotus (on poisons and antidotes), Leonides (on the genital organs and the rectum), Philagrius (on the spleen),[2] Rufus (on the plague). He seems to quote Aristotle at first hand. Aetius gives a good description of diphtheria in children, emphasising the foulness of the pharynx, and the suffocation in laryngeal cases; also how in convalescence drinks may still return through the nose. He describes moreover an interesting case of a girl who, when apparently recovered, died suddenly after the fortieth day; an issue which we understand better than he could do. As the "Syrian angina," diphtheria was well known to physicians of Greco-Roman times -as for instance to Archigenes (Aretaeus). We may observe the persistence of at least a part of the doctrines of Asclepiades (pp. 151 and 329) in the use of wine: *δεδώκαμεν αὐτῇ πίνειν τὸν οἶνον θερμόν, σχεδὸν ἀντὶ ὕδατος αὐτὸν προσφέροντες πότον* ("giving her to drink hot wine almost instead of water"), Aet. xvi. 75.

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[1] *Historical Relations of Medicine and Surgery*, 1905.

[2] Tralles flourished a little later than the great Lydian city of Sardes. The Lydians were very early traders, perhaps largely in retail, as Herodotus says they were the first people to use coined money.

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[1] Oribasius made his compilation to help Julian to declare that Medicine was not Christian, but wholly pagan.

[2] We owe to Aetius almost all the little we have of Philagrius and Posidonius.

The surgical excerpts of Aetius are no servile reproduction; much of them can be traced to the best of his predecessors. He describes torsion, ligature, and traumatic aneurysm. The eye chapters, indeed, are excellent, except as regards cataract; better than in the Lydian Alexander. In eye diseases he seems to speak with some personal authority, and this lamp he carried forward to the great Arab ophthalmic anatomist and surgeon, Alhasen, whose *Opticae Thesaurus*, like the works of Geber, give to Arab scientific literature something better than a derivative character. Like Soranus, he warns against the purulent conjunctivitis of the new-born. In dropsy, he says that the kidneys may be diseased; that the liver might be hardened in ascites was known already (F.L. p. 197).

Alexander, distinguished among the many medical Alexanders as of Tralles, in Lydia, is, if rather overrated, too great a man to be dismissed with an allusion. Born in the reign of Justinian, he was the youngest of five sons of Stephanus, physician in this thriving city. All his brothers attained distinction, and one of them was no less a person than the Brunelleschi of the sixth century, Anthemius, the architect of S. Sophia. Alexander, who lived for a while in Rome, but for the most part in Egypt and Phoenicia, was a polite scholar, and the greatest physician of the centuries after Galen until the revival of learning. Substantial, as in the light of recent research, were his borrowings from other authors, yet he was no mere conservator, no mere compiler, but contributed not a little out of his own personal knowledge and experience. A new treatise by Alexander has recently been discovered which is said to go to prove his capacity for compilation. It is a recipe book for wounds, ulcers, skin diseases, and bites of venomous animals, but is chiefly taken from Aetius, *Tetrabiblion*, as Wellmann[1] shows by parallel passages; and it comes in usefully for the text of Aetius. However these recipe-book makers all cribbed one from another; in the nature of things such collections must be largely compiled. It does not follow from Alexander's collection of traditional remedies that his clinical work was likewise all second-hand. Alexander had travelled far and wide in Gaul, Spain, and Italy. He often quotes Philumenus (F.L. p. 278); and although his reverence for Galen was profound, he did not hesitate, notwithstanding,

[1] Wellmann, *Hermes*, 1907, xlii. S. 533.

occasionally to criticise his great predecessor. But, I repeat that even Alexander was not untouched by the turbid spirit of the age ; nor when natural remedies, as for hiccough, epilepsy, colic, or gout, had failed, did he refrain from quackery and magic ; as for epilepsy cock's testicles or pounded ass's skull. On the other hand his description of epilepsy is good, and, like Brown-Sequard, he made applications to the seat of the aura. For phthisis he ordered sea voyages. For gout he relied on amulets ; or again on burned parts or dung of animals—for instance, burned horn or hoof of a sheep ; but the ash must be carefully placed on the corresponding side—right or left foot—of the patient. For an angina he advises the dried urine of a wild boar, a remedy which he picked up from a peasant in Gaul ! In Gaul he obtained other remedies also, such as the application of a piece of cloth steeped in the blood of a gladiator or executed criminal. The source of this " tip " he does not reveal. The defence made for Alexander is that he set forth stuff of this sort to get even with the quacks. But why, one might have asked him, why take the trouble to procrastinate ? Why waste time upon earthly medicine when magic was to be had ? (See p. 384.)

Alexander, as a practical physician, dealt little with anatomy or physiology, surgery, or gynaecology. As he was able in diagnosis and laid stress upon diet and regimen, his influence in the Middle Ages must on the whole have been widely beneficent, for Latin translations of his work were made before the ninth century. For his text we have many manuscripts, not the least of which is in our Library at Gonville and Caius College ; but, as his works have been admirably edited by Puschmann—to whose edition I desire to express my obligations—it is less necessary for me now to dwell at length on their contents. His influence on the Middle Ages probably filtered through Salerno, where he was much studied ; indeed we may suppose that to Alexander, a pious, high-minded man, the Salernitan school owed much of its sobriety and practical skill. For instance, we may note that Gariopontus, the great ancient of Salerno, adopted Alexander's division of the Fevers, and used the same prescriptions for them. His influence is evident also in Roger, in Gerard, in many of the writings in de Renzi's *Collectio Salernitana*, and so forward to Gilbertus Anglicus and the rest.

I have spoken of the seventh century as the lowest period of culture in the Empire ; in the eighth there was some little revival, due probably to influences from Bagdad and Syria ; but this, feeble as it was, was checked again by the turbulence of the Iconoclasts under Leo the Isaurian, when probably some Greeks fled, among other places, to Salerno ; South Italy being still, of course, a part of the Eastern Empire.

But I must hasten on to *Paul of Aegina*, who says plainly that he compiled and epitomised because doctors would not read the long-winded treatises of the ancients. He does not pretend to any originality, save, he says, in a few points of his own experience ; though it luckily happens that, in his turn, far away as he is from the "Cicero of medicine"—Oribasius, he preserves some very valuable materials, especially in the field of surgery. Oribasius nearly always gave his sources, Paul never ; indeed, Paul did not hesitate to assume to himself all extracts written in the first person. He helped himself freely from the collections of Oribasius ; luckily, as it happens, for, jejune as Paul's renderings are, they supply some of the lost parcels of Oribasius—for instance, much of Antyllus—records which obtained a high authority in the Arabian and later centuries. The great Arab surgeon Albucasis, indebted as he was to Oribasius, found much material also in Paul. Before the invention of printing, not only did the compendiums such as those of Paul, Aetius, Athenaeus, Stobaeus, Photius, lead to the neglect and loss of original manuscripts, but led also to the loss of much of the better but larger compilations, as of Oribasius. Indeed, by a kind of suicide, it would seem that by his *Synopsis* (p. 407) Oribasius killed or mutilated his own ampler work. As Galen says, copying was costly ; when the Egyptians forbade the export of papyrus, parchment was discovered, but it was so expensive that manuscripts were few ; and these few were preyed upon by moth, damp, war, and shipwreck. Galen's own library was burned in the fire of the Sacred Way ; and too often, like Celsus immured in some cloister, did manuscripts lie hid, to be discovered by remote generations more worthy of them. There are rumours indeed of fouler play ; that books were copied, and their bodies then destroyed by the thieves of their souls.

Paul, whose books, poor stuff for the most part, have for us this incidental value, seems to have practised in Alexandria, especially as a surgeon and obstetrician ; accordingly, like

Oribasius, he was a children's man. From Mnesitheus, Rufus, Soranus, Athenaeus, he describes their teething, convulsions, diarrhoea, aphthae, and four cynanches ; he seems indeed to have paid some personal attention to their cardiac disorders, though of course, in the lack of anatomical and physiological instruction, his teaching could not come to much. His gynaecological book is lost. In medicine, " phrenitis " was distinguished from delirium. Gout was attributed to inability of the system to cope with excess, or relative excess, of food—a fault in the *θρεπτικὴ δύναμις*, sometimes due to overwork—and the perverted products were apt to fall especially upon weaker parts. Do we know much more about gout to-day ?

But, I repeat, it is for their surgery that the doctrines or excerpts of Paul are of most value ; he was of a surgical bent, and the fuller and more interesting Sixth of his Seven Books was devoted to surgery ; indeed it was prescribed as a surgical text-book by the Paris Faculty. So far as we can judge, he was indebted to Hippocrates, Celsus, Soranus, Galen, Leonides, Antyllus. He does not mention torsion, but he knew the ligature : on the extraction of spear and arrow heads from wounds he is good ; he observed the points of diagnosis for wounds of the brain, and of the several viscera—*e.g.* haemoptysis in wounded lung, and the signs of a wounded diaphragm. On fractures and dislocations he is excellent. He denied fracture by contrecoup, taught by Soranus. He gives the directions of Antyllus on tracheotomy ; he dealt with nasal polypi, excised the tonsil, tapped the abdomen, and detected water in the joints. He resected ribs for empyema ; he used the catheter ; he cut for stone, and gives good directions for washing out the bladder with an ox bladder attached to a catheter. The late Professor Marsh told me that on lithotomy Paul was excellent. He operated for staphyloma. His rectal and vaginal specula were fitted with expanding screws.[1] Paul was an afterglow of Celsus.

If we are right in supposing that Paul studied at Alexandria in A.D. 640, it must have been just before the pillage by the Arabs, and the consequent catastrophe of science and erudition ; so we may be thankful for what he salved. But before, on the rise of the Arabian schools, I relinquish my story of the Greek medical authors, I may say briefly for the rest that during the eighth, ninth, and tenth centuries Greek medicine had fallen so far into decadence as to offer little to interest us. Indeed in all departments Constantinople, menaced without by perpetual wars, rent within by controversies as bitter as vain, and by palace intrigues, then sank into deep degradation. *Theophilus* the Protospatharius—an office of the Guard in the Byzantine court, did indeed make some contributions to medical knowledge, especially in anatomy; the most important of these, whether his own or not, was the conception of the bony spine and skull as developed in correlation with that of the central nervous masses. Unfortunately his anatomy and physiology were wrested out of value by the arbitrary teleology which, as I have said, dominated the thought of the time.[1] But his great vogue in the Middle Ages was won, not by these merits, but by one of the chief of those books on Uroscopy which took so extravagant a part in medieval diagnosis, and by a celebrated but fanciful book on the pulse. His place in the Imperial Guard shows, by the way, that the social rank of Medicine in those days was one of distinction.

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[1] See Mr. Wellcome's Museum.

Passing over certain negligible persons of this dark period of medicine, I may make mention of one other with whom, as Haeser says, this period may be concluded with some distinction, namely *Johannes* (*the*) *Actuarius*, this, again, being the title of one of the court appointments. Although it would not be fair to his predecessors to accuse them of teaching that uroscopy contained within itself the secret of diagnosis, for many of them taught plainly that the patient was to be examined at all points, yet the fantasy and mysticism, and the factitious physiology which too often marked their writings on the subject, encouraged the extravagant pretensions of the uroscopists of later centuries. From such extravagance John was free; he had absorbed not only the dogmas of Hippocrates and Galen, but their spirit also. He was a highly educated man, familiar with post-Galenic medicine, a shrewd observer, and of sound judgement. Neuburger goes as far as to call him a forerunner (*Vorbote*) of the Renaissance. In this writer we can see how the doctrine of the pneuma, of which in my FitzPatrick Lectures I have said so much, persisted after the dissolution of the Sect through the generations which followed down to the eighteenth century. John the Actuary wrote two Books *De spiritu animali*, and often, very fancifully, found this dynamic entity in every bodily function. Accepting the blend with the four elements and the four humours he devised one more system of crases, dyscrases, and crises (as of urine and pulse). The Second Book is the practical part; it is easy in style, sententious, and often aphorismal. This blend of the pneumatist and humoral pathologies continued to prevail through the Arab period to later times, as in the doctrines of fever. John regarded the urine rightly as an excretion from which much information could be obtained, though by no means all. But in this rapid survey I can go no further than to indicate his eminent services to psychology also, and to the therapeutics of mental disorders. As a student he had been well trained in philosophy, and in later life brought to this study the practical knowledge and experience of the physician. Thus he was able to point out the dependence of mental symptoms upon bodily causes—upon errors of diet, impurities of the blood, intemperance, and so forth: and upon this rational basis he prescribed a system of cure by diet, baths, and exercises, which he wisely said would influence for good, not only the physical and vital pneuma, but also the *pneuma psychicum*. That, partly because of the influence of oriental demonism, these intelligent and humane doctrines (see also p. 256) were for a thousand years forgotten, and the treatment of the insane degraded to brutality was the shame of the Middle Ages and of the Renaissance; of Christianity and of Medicine.

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[1] His treatises *Περὶ οὔρων* and *Περὶ διαχωρημάτων* (a mode of diagnosis by the faeces) are in Ideler. Most of his work was copy or paraphrase of Galen, especially his *Περὶ τῆς τοῦ ἀνθρώπου παρασκευῆς* from the *De usu partium*.

In the Byzantine period the encyclopedic methods of which I have spoken became more and more laboured, and the world was enriched or burdened by such collections as those of Isidore[1] of the seventh century, Photius of the ninth, Theophanes Nonnus of the tenth, and Psellus of the eleventh, most of which, Psellus especially,[2] included some medicine; but the *Myriobiblion* of *Photius* consisted almost entirely of portions of some three hundred classical books, some of which, such as Arrian and Diodorus Siculus, would otherwise have been lost. In *Isidore* the medical section is compiled mainly from Caelius Aurelianus

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[1] A very convenient edition of Isidore's *De septem liberalibus disciplinis etymologiae*, in two small volumes, has recently been published by the Oxford Press, but, shocking to record, without a date.

[2] See Ideler, *Phys. et med. Gr. min.*

(itself largely from Soranus, p. 215); his Medical chapter is headed "Medicinae curatio spernanda non est," and he withstands some fanatic Christians who denounced Medicine as impious. He points out that remedies are recognised in the New Testament. The greater Fathers of the Church agreed with him, or he with them. Besides, Isidore says that a doctor must know all sciences, whereas the students of other liberal arts are content each with his own. "Oportet enim medicum et praeterita agnoscere, et praesentia scire, et futura praevidere" (*Et.* iv. 10). After the Hippocratic tradition he held, like Soranus (Cael. Aur.), that dietetics must have a high place in therapeutics, as opposed to the primitive way of treating disease by pharmacy;[1] and, though of entirely uncritical mind, he avoided superstitious, fantastic, and obscene remedies. As the *Isagoge* or *Responsions* of Caelius Aurelianus and the pseudo-Soranus were a ready, compendious, and wholesome source for Isidore and Bede, so the influence of that eminent physician filtered down through Cassiodorus and the Fathers.

Isidore (iv. 1) gives a report of the three chief sects or heresies of Medicine.[2] His summary of early Medical history is as follows: "Sed postquam fulminis ictu Aesculapius interiit, interdicta fertur medendi cura; et ars simul cum auctore defecit, latuitque per annos pene D. usque ad tempus Artaxersis regis Persarum. Tunc eam revocavit in lucem Hippocrates Asclepio patre genitus in insula Coo" (*Et.* iv. 3). But, valuable as are the nuggets of tradition which may be picked up here and there, we must not look to these diligent compilers for much more than curiosities. I ought to add however that Photius and Psellus, like Alexander of Tralles, were no inconsiderable humanists; and from this point of view their otherwise rather tedious pages may be glanced over, not without profit. Psellus put much trust in the Hermetic books, in alchemy, in the potency of gems, and so forth. One of the treatises of Psellus is entitled Περὶ ἐνεργείας δαιμόνων; it is not exactly a manual of the demonistic pathology of which I have spoken already, but a description of the guises in which unclean spirits may lurk; it shows a considerable familiarity with the natural history of these creatures—*lucifera*, "*aquea*," *et subterranea*—and of their abominable functions and rites. The doctors who vulgarly attributed their malign work to a vitiation of the bodily humours are suitably reproved. *Theophanes Nonnus* was a Doctor of Medicine, ordered by the learned Constantine Porphyrogenitus to compile the medical portion of an encyclopedia. This he did, in 290 short chapters, from Oribasius, Aetius, Alexander of Tralles, and Paul; none of whom, as Greenhill remarks, does he mention. This contribution, which has been falsely attributed to Psellus, was entitled Ἐπιτομὴ τῆς ἰατρικῆς ἁπάσης τέχνης; or for short Ἰατρικόν. It went through many editions. In the National Library of Paris there is also a tract of his on dietetics. In themselves these summaries are of little historical value, but Theophanes is worthy of respect for his almost entire freedom from the superstitions of his age; indeed he repudiates the demonic hypothesis of epilepsy. Herein Theophanes is in striking contrast with his successor Psellus.

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[1] See "Salutaria Praecepta" in Val. Rose, *An.* ii. 196.

[2] Isidore did not use the Greek originals; the matter came through the latin translations of that time, cf. the words "latinizare" and "latinator." In respect of these paragraphs see Probst, *Arch. f. Gesch. Med.* viii. 1, 1914. The book called *Botanicum* by Isidore, and Cassiodorus, was Dioscorides (Probst).

I must not in my haste omit some notice of the surgical collection of *Niketas* at the end of the eleventh century, a valuable record of ancient surgery on which I have made some interesting notes which time forbids me to read. In the Florence manuscript there are some coloured illustrations; and Schöne, in his edition of Apollonius of Kitium, finds evidence that certain of these later illustrations may have come down to us from those of the original authors (see F.L. p. 367).

I have spoken of demonism and of magic as sapping the pathology and therapeutics of the Byzantine and Middle Ages; another baneful practice also prevailed, a phase of superstition which, even within the memory of some of those present, was not obsolete. When I began practice it was customary at every consultation to prepare a writing-table, pens, and ink for "the prescription." This script, even in my young days, was of formidable composition, a drug for every symptom, and a few more for the pool; it was solemnly set forth, and signed by the two or more physicians; by the patient's friends this was understood, if but long enough, to be the organ of his restoration. No occasion was left for modification according to circumstances, or the various phases of the disorder; to it the doctor in attendance was to be as submissive as the patient to whom it was scrupulously administered in all its phases—potion, pill, and plaster. To it all else was subordinate; for dietetics, a strong feature of ancient medicine, had fallen into some neglect or perversity. If the recipe failed, well the consultant and home doctor together had not hit off the precise formula. If the formula succeeded it was treasured like a banknote, the more handled and soiled the more genuine, and the more precious as it was not a "wasting asset"; its virtues could without expense be bestowed upon any suppliant. Now Hippocratic therapeutics had been rational, and based wholesomely upon the springs of man's nature—on means such as diet, exercises, baths, and climate; and Erasistrateans had protested against much drugging, numerous recipes, and so forth (F.L. p. 154); but in Byzantine times these rational methods were superseded by a belief in the quasi-magical virtues of a medley of drugs, and by modes of practice which, on the one hand, touched upon the gruesome art and mystery of poisons and antidotes (F.L. p. 355) which had flourished from the third century B.C. onwards—a tradition which by rights should find a place in this lecture—and, on the other, was derived from the semi-magical closet of the republican paterfamilias, wherein, with their Penates, patricians of the race of Cato kept their panaceas (F.L. p. 25). The vogue of this recipe medicine may conveniently be dated from Scribonius Largus, whose work on the Composition of Medicines—*thesaurus verius quam liber*, as an old editor says of it [1]—written in the reign of Claudius and, naturalised Roman as he was, in barbarous latin—owed much, as indeed he honestly says, to Greek physicians mostly unknown; but a part no doubt, to the *Alexipharmaka* and *Theriaka* of Nicander in the second century B.C.; and so in its turn became a widow's cruse for the writers of many a following century. We may believe him when he says that he constructed the majority of his receipts himself.[2] The great Greek botanist and physician *Dioscorides*, of Cilicia, in the second century A.D., stood head and shoulders above these pharmacopolists; but, ascendant as he was, he failed to stem the flood of recipe books which for many a century never dried up; and if Nicander did not begin, at any rate he perpetuated, the futile method of attaching the recipes to their respective diseases or symptoms. It is fair however to add that in Scribonius there is some substantial surgery; and, according to Haeser, he was the first to make a pure preparation of opium (p. 371). It would be endless and not very profitable to pursue the muddy stream of polypharmacy from Scribonius to later doctors, Greek and neo-Latin—Placitus, Lucius Appuleius a botanist of the 4th century, Serenus Samonicus,[1] Theodore Priscian,[2] Marcellus Empiricus of Bordeaux, Paulus Jovius, Plinius Valerianus, and the rest of them, down to the *Antidotarium* of Nicholas "Praepositus"[3] of Salerno, the *Dynameron* of the Alexandrian Nicholas (Myrepsus or Unguentarius) of the thirteenth century, and into many another volume of formulas, Greek, Latin, and Arabian.[4] The celebrated collection of recipes in the 48 chapters of this Nicholas, Greek, Latin, and Arab, some of them not met with elsewhere, became the official Pharmacopoeia of the Faculty of Paris. In the sixteenth century a revision of it was called for, but nothing was done for another century and a half; then it was wholly superseded. The word "apothecary" by the way in those times did not necessarily mean druggist; there were stores and storekeepers of other kinds, of records and accounts; for example, the druggists were *ῥιζοτόμοι* and *φαρμακοπῶλαι* (the cullers and the sellers of the simples); and some of them *φαρμακοί*, *i.e.* poisoners or sorcerers.[5]

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[1] Adding, "Nunc primum tineis et blattis ereptus . . . industria Joannis Ruellii Doctoris disertissimi."

[2] Haller scoffs at Scribonius for his old woman's receipts, but these are few, and were no doubt popular remedies. On the whole, if we overlook stag's horn, hyena skin, and liver of a stabbed gladiator, his prescriptions were sound and intelligent and few superstitious. Some Hippocratic medicine is not free from primitive ingredients. Many of these recipe books were not for doctors, but for domestic use.

We are drifting down upon gloomy and decadent times; upon night and the chimeras of the night. Before concluding my lecture let us turn our eyes, if but for a moment, towards the coming light, some tender radiance of dawn. In the third and fourth centuries the evening was falling, fading with soft harmonies. The sweet influence of Virgil, the Roman love of

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[1] A wearisome versifier of medicine, but a man of some attainments and elegant scholarship, and one of the few Latin physicians.

[2] See Schonack's Scribonius and the edition of Priscian by Meyer. See also p. 387 of this volume.

[3] The title of Praepositus got attached to him in the fifteenth century from a translator of William of Salicet called Nicole Prevoste.

[4] The doctors of the eighth to the thirteenth century were nearly all laymen. Salerno was no independent or sudden phenomenon.

[5] These parts of early pharmacy are dealt with more fully in FitzPatrick Lectures, Chap. XVII., but for the convenience of the reader of this lecture I have not deleted these paragraphs.

Nature, the haze of mystic beliefs, the new contemplations wafting from east to west—not robust, it is true, but sentimental and pathetic, and at their best almost Wordsworthian in their spiritual joy in Nature—were setting. Yet this love of Nature had been not only for her gentle and picturesque moods, but also for the solemnity and glory of the mountain forms which we flatter ourselves that we were the first to adore, but which were adored by Augustin and Paulinus of Nola, and after them by Cassiodorus, whose passionate love for Como, its lake and its mountains with their beauty of form and colour, reminds us of "Salve, O Venusta Sirmio," and is far away from the vapid and imitative productions of the "Dark Ages," which prevailed before the Nature poetry returned again in the medieval romance writers; first in the monasteries, thence down to Chaucer. This was the dawn, the silver or Latin revival, under Bede, Alfred, Charles the Great, and Alcwin (725–804)—sometime a boy, afterwards headmaster, of my own school of St. Peter. And in this period grew up the medieval latin, that adaptable, expressive, and universal language with which we are familiar in medical works of that time and onwards. It may be that in this dawn science also showed some, but not very apparent, awakening from slumber. Some readers see it in the *Physica* of the *Abbess Hildegard* of Bingen in the twelfth century (1099–1179). Her book I perused some years ago, and its system, its clearness and concision, and its learning I admit;[1] there is moreover some fair medicine in it, especially concerning healing waters; but it is conceived on formal and stereotyped lines, each herb or metal being characterised punctiliously by its humoral qualities, without any freshness of personal observation. Hildegard was no doubt a learned and interesting woman, but can hardly be regarded as the harbinger of a medical renaissance. In one of the last of the Byzantine tradition, Simeon Seth (Σήθ) (eleventh century), we may perceive a new influence, a transition towards the medieval and modern. In his manual of Materia Medica he makes the first mention of camphor. His Περὶ τροφῶν δυνάμεων—on the virtues of plants and fruits—was translated into arabic. It contained some new matter from the East, but was mainly taken from Galen.

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[1] Outside my subject, the descriptions of the plants and minerals used as remedies have interesting points, and there is some more or less original folk-lore. The German synonyms for natural objects also are of interest. The *De rerum naturis* of Alexander Neckam, and the *Speculum majus* of Vincent of Beauvais, who gathered from William of Conches, and was afterwards superseded by translations of Pliny, were written a century later. Neckam is the more entertaining; he writes in good latin, spiced with many anecdotes and lively details.

We might indeed have expected more of Hildegard, seeing that the Arabian tide, a wondrous reawakening of science and medicine, was then on the flow. Arabian I have called it according to reasonable custom; but we must not forget that it should rather be called Syrian Hellenism. I have said that after Constantine the greater physicians were for the most part Christian, and that the Nestorians, on their expulsion, carried with them eastwards many manuscripts, a scholastic tradition, and much individual skill and experience. Already, under the Seleucids, *Syria* had become more Greek than is usually realised, especially in cities such as Antioch and, until the earthquake under Justinian, at Beyrut. There were academic schools in Mesopotamia; at Nisibis and Edessa also; and when Nestorius and his disciples, ejected from Edessa, carried their learning and fame to Gondisapor in Persia, they were honourably received under the tolerant Sassanian rule. In Rome however, Eastern and Western, as in France during the religious wars, and as indeed in ancient Greece, the banishment of its ablest men enfeebled the State. At Gondisapor, from the end of the fifth century if not earlier, there was a medical school with a hospital attached to it; and for many generations this Studium survived the inroads of Islam, and was the chief seat of learning in the East. Thus Syria became a land of men of science and of doctors, many of them Christian; in the sixth century Christian Syrians were translating Aristotle and other Greek manuscripts into syriac and arabic; so fulfilling in that generation the function which in the next phase of the revival was performed by such translators, from these languages into latin, as Gerard of Cremona, and Constantine of Carthage. Honein (Johannitius) translated Galen and other greek writings into arabic.[1] But it was not till the twelfth century or thereabouts that Arab influence made itself felt in Salerno, for this school was originally independent of oriental tradition. But to come into sight of the Arab schools is to reach the limits of our period.

I must touch, at least in passing if I cannot enter into, the

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[1] See one of Charles Singer's many interesting essays. *Studies of Hist. and Method of Science*. Oxford, 1917

Military Medicine of Byzantium; for this sphere of work is most interesting to us in the lives of many great men of our art, from the Thessalian dukes Podalirius and Machaon onwards to Paré and Harvey, who in military service found a fruitful experience; perhaps indeed the nursery of their genius. But, as we have now an adequate study of it by Haberling,[1] I feel the less called upon to describe it. I may remark, however, that recent excavations, for instance at Caruntum, near Vienna,[2] have revealed to us that military hospitals were more complete and permanent institutions than we had supposed. With the formation of a standing army under Augustus they were greatly developed; and although with the growth of Christianity the hospital, and, what is more important, the charitable spirit, grew abundantly; yet we cannot accept the common and still prevalent tribute that the hospital owes its birth to Christianity. To hospitals as charities there were many gradations; from Asclepian temples, surgeons' apartments where patients were received—*ἰατρεῖα*, *officinae medicinae*[3]—*valetudinaria* for slaves, hospitals for special diseases such as leprosy, to many other medical institutions often attended by several doctors, and some of them having a public status. Under the Flavian emperors, when Christianity was young, such institutions, planned on the corridor system and governed by strict rules of cleanliness, purification, nursing, and good cookery, were already highly developed (p. 464). And before Christ we read of hospitals in provinces, especially the Greek provinces, under public control, with doctors officially appointed to them (see Galen, xviii. (b), S. 678).

Edessa was provided with two large hospitals, with medical schools attached; and not only in Toledo and Cordova, but also long before in Bagdad and Cairo and other non-Christian countries, great hospitals and medical schools were established by the Saracens. In Christian Byzantium a large hospital, then no new institution, was opened by Justinian and Theodora near S. Sophia, and the Hospital of the four Martyrs was founded by Isaac Angelus; not to reckon innumerable lazar-houses, foundling-homes, and so forth.

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[1] W. Haberling, *Militärlazarette im alten Rom*, Berlin, 1909, contains plans, etc.; also *Die altrömischen Militärärzte*, H. 42 d. Veröffentl. aus d. Gebiete d. Sanitätswesens, Berlin, 1910. I leave the following pages as they were written, but I have since dealt more fully with this part of the subject in the Linacre Lecture, pp. 464 *et seq* of this volume.

[2] See Haberling, *loc. cit.*

[3] See the early *locus classicus*, Plautus, *Menaech.* v. 5.

Basil's well-known hospital at Caesarea was not the first even in this city. In earlier times Anna Comnena was an ardent doctor, and so was the Emperor Manuel, who himself practised with potions and salves. In the West, out of the hospices for the reception of strangers, hospitals sprang up on the great roads—about the monasteries therefore, and near the bridges; thus the full title of the chief hospital of Lyons is the Hôtel Dieu du Pont du Rhône (see Linacre Lect. p. 473).

But I must stop, although, so abundant is the matter, there is no reason but your weariness why I should not prose on for another hour, or many an hour. My excuse, which I am sure you will accept, for my cause if not for myself, is that, in the words of a far greater historian, the history of knowledge is knowledge itself.

Many useful references and valuable material and criticism I owe to Harnack's *Medicinisches aus der ältesten Kirchengeschichte*, 1892, and I am obliged also for some details and references to Dr. Franz Strunz's tract on *Gesch. d. Naturwissenschaften im Mittelalter*, and should have been still more obliged to him had he provided it with an index.

Of special treatises the chief on the present period is Puschmann's excellent edition of Alexander of Tralles, with a full introduction and text, and with (what I confess is not unwelcome to me) a translation on the opposite pages. From Neuburger's *History* I ought to have gleaned more than I have done. It has been on my shelves from its publication, but much of my reading on the subject had then been done, and, with the war upon us, I had not time to do more than consult it occasionally on matters of obscurity or dispute; but this with advantage. To Schonack's Scribonius, Meyer's Priscian, and a few other special essays, I have made reference in the text. The debt of all historians of medicine to Diels and his disciples, especially to Wellmann, is too large for formal reckoning, and, like that to Greenhill, Adams, Littré and Daremberg, perennial. I may add that I find Darmstaedter's *Handbuch z. Gesch. d. Naturwissenschaften*, 1908, to be a most useful companion on the scientific historian's writing-table.

SALERNO[1]

In my last paper to the Eranus, in 1910, I ventured to occupy the evening with some story of certain of the Greek physicians in Rome ; especially with some account of Asclepiades and Archigenes, whose considerable services to medical practice and doctrine fortified and enriched the traditions of Medicine for many after generations ; though not always to their own renown, as after the manner of those times, their works were so captured by later literary adventurers that the very names of the original authors fell into an oblivion from which it is the honour of later scholars —and here I may refer especially to the school of Diels—to rescue them.

As an undergraduate it was my good fortune to travel in Calabria and Sicily as well as in Greece, and the impressions I then received of the part of Magna Graecia in carrying forward the torch of the Greek genius into the West have but grown with later years. While on the Council of the Hellenic Society it was my chief desire to promote research in these lands in order to discover the channels and the monuments of this propagation, whether by trade-routes or by schools ; but to this Club the difficulties of putting such schemes into execution are only too well known. We may now however be hopeful that the brilliant and successful endeavours of Italian physicians to subdue the malaria, and thus to restore these naturally lovely lands to the uses of mankind, may be successful indirectly also in revealing more and more of those traces of ancient culture of which I am to speak to-night. The remarkable argument of Mr. W. H. S. Jones on the part of malaria in the fall of the great states of Magna Graecia, a fall so rapid, so overwhelming, and hitherto so inexplicable, is familiar enough to allow me now to pass it by.

Meanwhile we have had to be content with little jets of information which have come to light almost by chance. A few years ago certain evidence, not very strong perhaps in itself but not without its significance, was produced to show that the Pisani were of Apulian origin, and that by them, and from this region, the Greek spirit in sculpture had flowed into the more ascetic art of Northern and Central Italy. The sources of Niccola's inspiration were discovered in the surviving Greek and Greco-Roman sarcophagus reliefs, in the fragments of sculpture at Capua, and so forth; and took form later in the well-known carvings of the pulpit at Ravello; and there is much more matter of this kind yet in the womb of time. It is perhaps not too fanciful to trace the Greek spirit in other South Italians, not artists, as in such distinguished men as Paulinus and Bruno of Nola, Telesius, Campanella, Baptista Porta, and other champions of a Greek freedom of the human mind; and in literary treasures. If the discovery in Amalfi of the first copy of the *Pandects* now in S. Lorenzo at Florence be a fable, at any rate it signifies that there was no improbability in the story. Under King Roger Amalfi flourished as a School of Law, as did Benevento as a School of Philosophy. For not all of South Italy was devastated by the malaria fiend; Salerno now enjoys, as proverbially in the far past it has enjoyed, a delightful climate; and of late years—since trying for things has so happily supplemented the mere study of books—much matter of great interest in respect of the tradition of the Greek spirit in Salerno has come to light. Of this I will attempt some brief indication.

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[1] An essay read to the Eranus Club in Cambridge 1912.

In Rome Greek literature and science had always been more or less of a veneer; and after the Antonines originality, in science at any rate, seemed to dry up, so that for centuries to come authors were content to produce summaries, aphoristic collections, and audacious fakes of older works without the smallest sign of their indebtedness. And this was not true of Rome only; unfortunately the Greek spirit itself fell for a while into eclipse; though in Asia Minor a few physicians, such as Alexander of Tralles, still showed something of the old inspiration. In the fourth century there were not a few eminent physicians in Byzantium, Alexandria, and Asia Minor; still on the whole the Byzantine system stifled mental activity, and medical literature was represented only by such encyclopedias as those of Oribasius, Aetius, and Paul of Aegina, compilations which notwithstanding, by salvage of writings which otherwise might have been utterly lost, did priceless service to the historian. And, beside these, the endless succession of herbaries, recipe books, and antidotariums, like lower organisms, propagated their futile kind. The fourth of the twenty books of *Origines* or *Etymologiae* of Isidore (596-636) was largely taken from Caelius Aurelianus, as his matter had been from Soranus and Archigenes; and the well-known Abbot of Fulda—Rabanus Maurus—wrote a similar encyclopedia, with chapters on disease and medicines. The temper of the rising Christian influence was towards ascetism, and a contempt of this transient world of sin; also by incessant wars and rumours of wars within and without the people were cowed. Although again from the east flashed up the unquenchable Greek light, again to irradiate the west, as it irradiated India and even Turkestan, now it was iridescent with superstitions and fantastic heresies; neolatins, doctors, sophists, and others began to swarm on land and sea, and the Greek language, veneer as it had been in Rome, vanished; in the sixth century greek had dropped out, and a kind of latin had taken its place. For instance, Cassiodorus counselled the monks of M. Cassino to learn greek by reading Dioscorides, for the manuscripts of Hippocrates, Galen, and Caelius Aurelianus in their library were in latin.[1] He seems to have had a bent to diseases of the eye; he studied the writings of Demosthenes (p. 162) and others, and M. Cassino, which was more or less a medical school, won some repute as an eye-clinic. A little later the treatment of these diseases was distributed among some surgeons, but more among quacksalvers, and other lay empirics.

Notwithstanding, we are not to suppose that, in the irruptions of warriors and other adventurers, science and letters were wholly obliterated, or even altogether submerged. The ancient barbarians had more reverence for monuments and letters than those of the twentieth century. It was not under Theodoric and Cassiodorus only that the supremacy of learning was acknowledged, and even promoted. Up to the seventh century at least, Imperial and Palatine as well as clerical and episcopal schools were in active life; and the Gothic chiefs on the whole treated letters and science decently. Under Constantine in the East, Greek schools throve abundantly—as in Athens, Constantinople, Nicomedia, Antioch, Berytus, Alexandria, Tarsus—probably in all large cities. In the fourth century however Nicomedia and Antioch began to dwindle. Philosophy, mathematics, and astronomy were the ruling studies, and these schools were happy not only in the lightness of government control, but also in the absence of organising and special Boards and Syndicates and, above all, of examinations. And they had long vacations like our own! Archiaters (p. 456) were in honour under the dim renaissance of the Merovingian and Carolingian kings. At M. Cassino, St. Gall, and Einsiedeln in the sixth and seventh centuries many medical and scientific treatises were copied again and again and translations made; in science, of Dioscorides, Galen, Oribasius, Soranus, etc.: MSS. of the eighth century now lie at St. Gall, and MSS. of the eighth to the eleventh at Berne. Of Western scholars Erigena was probably not the only one who could translate from greek to very fair latin. But such scholars were, it is true, mainly of the Levant: such as Anastasius the bibliothecarius who is said to have revised and corrected Erigena's translations.[1] The noble service to science and letters of Alcwin, a scholar and afterwards the head-master of St. Peter's at York, is too well known to need emphasis; and in his own words we have a definition of "Medicina, scientia curationum ad corporis salutem inventa." Medical manuscripts of the eleventh to thirteenth century repose also in the Library of our own University.

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[1] An interesting example of Greek medicine in latin dialect of about the end of the fifth century is at hand in Val. Rose's *Anecdota*. It is an epistle, for the most part taken from Alexander of Tralles, by one Anthimus, a legate, and though he wrote in Latin or Greek, to Theuderic and entitled *De observ. ciborum, epist. ad glor. Theudericum reg. Francorum.*

A ray of light is thrown on this subject by the record of the chronicler Richer of Rheims, pupil of Gerbert, the founder of the medical school of Rheims after the pattern of Chartres; in the tenth century (d. 1010) he travelled in search of manuscripts, and rejoiced in his finds at Chartres; some such MSS., now at Chartres or in Paris—with manuscripts of Dioscorides or of Alexander of Tralles—are pretty surely of those by which the eyes of Richer were delighted; namely, the *Ophthalmicus* of Demosthenes Philalethes (under Nero)—an Alexandrian of the School of Herophilus (p. 162)—which Gerbert had begged from an Italian monk, and latin translations and abridgements of (parts of)

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[1] See Teuffel, *Gesch. röm. Lit.*, 1890, and Schanz, *G. röm. L.*, 1904; Esposito, *Class. Rev.*, Feb. and March 1918; and Manitius, *G. d. lat. Lib. d. Mittelalters*, quoted Esposito.

Hippocrates, Soranus, and Galen (Sandys).[1] How flourishing was the school of Chartres in the tenth to the eleventh century, under Fulbert, another pupil of Gerbert, is well known, and is set forth by Sir John Sandys (*Hist. Class. Schol.* i. 489-91), with ample references. The school of Bordeaux also began to flourish greatly under Roman rule, and became (say in the tenth century) the most famous seat of learning in Gaul. Students frequented it from all parts of the Empire. Ausonius was a physician, and he, and Vindicianus the African friend of Augustine, Marcus Empiricus, and the copious medical poetaster Serenus Samonicus, were "old Burdigalians." All these writers relied more or less on magic and amulets. Sandys says that Fulbert included medicine in his range of studies; this is part of a larger truth, for "Physica" (the term retained still in the title of my own Chair) entered into the complete education of the time,[2] and truly as a part of Nature study, as we may read *ambulando* in the life of the great Albert himself. Moreover, scarce and forgotten as were complete or authentic manuscripts of Celsus, historians are disposed to think that his influence in one way or another never died out. So that if in the Dark Ages pruning-hooks were turned into swords, and the parchments of old greek writers into mass-books and psalters, nevertheless all through these savage times rivulets of Greek tradition, of Greek thought, and even of Greek manuscript, if exiguous or underground, were perennial. The remarkable discovery by the Provost of Eton of a greco-latin lexicon of 16,000 words, though I understand of the thirteenth century, yet must signify a strong underground current of greek, for such a glossary does not spring into life all at once. Besides, it is notable that the Mag. Nicholas therein quoted, was a native of Calabria or Sicily. I now lay upon the table the Laon greco-latin glossary of the ninth century.

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[1] The following notes I owe to the kindness of Sir John Sandys.

"Salerni iam inde a saeculo decimo medicinam adeo floruisse, ut e remotissimis terris aegrotantes eo confluerent, neminem fugit, neque minus notum est, saeculo undecimo medicinae doctores ibidem societatem quandam litterariam iniisse ad universitatum fere, quas dicimus, rationem. Haec vero medicinae peritia, qua tum Salernum florebat, haud dubie ex arte illa grammatica et poetica, quas diximus, tanquam ex fontibus erat profecta. Libros enim, ex quibus rerum medicarum cognitio hauriebatur, ex Graeco et Arabico in Latinum sermonem verti oportebat, eosdemque fere Salerni grammaticos praestantes et medicos peritissimos videmus celebratos, ut Alphanum et Guaiferium, de quibus post pluribus agam. Praecepta denique illa clarissima de conservanda corporis salute, quae hac aetate composita nomine 'Scholae Salernitanae' circumferuntur, hexametris sunt edita versibus" (Giesebrecht, *De litterarum studiis apud Italos primis medii aevi saeculis*, Berlin, 1845, p. 20).

NOTE TO THE ABOVE PASSAGE:—"Testimonia, quae in Salerni laudem Tiraboschius collegit [iii. 364], iam multis augere licet. Magnum enim Salerni nomen esse in carminibus et Germanicis et Franco-gallicis medii aevi, unusquisque compertum habet. Ac iam Richerus, ipse haud mediocriter arte medica instructus, mentionem facit medici cuiusdam Salernitani, qui magnum apud reginam Francorum favorem assequutus erat. *Mon. Germ. Script.* iii. 600-1. Iucundissimum mihi videtur Archipoetae carmen de itinere Salernitano, nuper a J. Grimmio editum. Ubi inter alia haec quoque leguntur:

Laudibus eternum nullum (?) negat esse Salernum,
Illuc pro morbis totus circumfluit orbis,
Etc., etc., etc."

(H. O. Taylor, *The Mediaeval Mind* (1911), i. 250 n. 4:—"At Salerno, according to the Constitution of Frederick II., three years' preliminary study of the *scientia logicalis* was demanded, because 'numquam sciri potest scientia medicinae nisi de scientia logicali aliquid praesciatur' (cited by Novati, *L' Influsso del pensiero latino*, 1899, 220[2])").

[2] See Chapter on Celsus, p. 202; and paragraphs on Ionian and Sicilian philosophers.

If students swarmed after great teachers so they swarmed after those rare and costly treasures—for such to the poor student they were—the manuscripts. The geography and travels of manuscripts has been for many years if not a study at least a fancy of mine, for where the manuscripts were there were the students gathered together. When Frederick the Second bartered with the Sultan for manuscripts of Constantinople, he gave Naples a great advantage over Salerno; probably thus Montpellier owed much of its renown to the neighbourhood of Cordova with its reputed 600,000 books. Paris again, as we well know, although in later times suffocated by pharisaism, in the days of which we are speaking was no whit behind Italy in its libraries and in its intellectual ardour. One might almost regret that manuscripts have ever been removed; had they lain still to be excavated, after their strata, with modern scrupulosity, we should have had more illumination upon the history of *Studia*; but the history would have been different, for after all the maxim holds good—to him that hath shall be given. Latin MSS., if one may skim an impression from Diels' catalogue of medical MSS. in Europe, stayed on the whole pretty much where they were written; it was the Greek which were hunted, scattered, and carried westward; in all old libraries some of them are to be found:—hand books, recipe books, herbals, urine books, dietaries *ad nauseam*, scraps compiled in part of Pliny, in part of Dioscorides, and of other sources, but also stuffed with the fabulous, magical, extravagant, and too often disgusting lore of such writers as Myrepsus, and that egregious poetaster who assumed the name of Lucius Appuleius (p. 381). It was not till the fifteenth century that manuscripts had any distinctively national character.

It is in this context that I would demur to the prepossession of academical historians, at any rate of the last generation, that the ancient universities were usually "founded." Salerno was never "founded," neither by Greeks, nor by Jews, nor by Constantine, nor by Charlemagne, nor of course by Benedictines. Benjamin of Tudela, who visited Salerno in 1160, said it was wholly Christian, that he found no Jew there; yet assuredly there had been, for among its writers were a Judas, a Joshua, and a Joseph (De Renzi). Within universities it is true that colleges were founded; but the growth of a seat of study depended on trade centres, on libraries, and on the attraction of such and such a teacher or band of teachers; thus, like animals and plants, universities were not special creations, nor of precise origin; they just grew. Naples was perhaps the first university to be definitely founded. It has been absurdly alleged that Cambridge was "founded" by a colony from Oxford; but in the days of which we are speaking such schools were not static bodies with students inscript and adscript as at present; the student drifted hither and thither as teachers, libraries, commercial activity, and provincial rivalries tempted him; if he were dissatisfied or satiated with one university he promptly deported himself to another; as continually between Oxford and Paris, and no doubt between Oxford, Cambridge, and Stamford. In the Middle Ages most students sucked their honey not in one place but in many lands and many wander-years. A university grew in Cambridge because Cambridge, like Bologna which on the Via Aemilia commanded the highway through the Apennines, was a very strong and important post, and the centre of a rich trade. In Roman times there was in Cambridge at least one Collegium or Guild, and probably some guilds of learning; so slowly—more slowly than in Oxford, the occasional seat of kings, and attached for weal of medieval renown, if for woe of modern ideas, to Paris—from small beginnings in a busy resort of men a university grew imperceptibly. So was it with Salerno which also occupied an attractive position, though for other reasons than that of Cambridge; and Salerno retained more directly than we did the intellectual inheritance of a Greek Colony recolonised by the Romans. In the Middle Ages that city became a bishopric, then an archbishopric; and, as was customary, about these seats were schools of various culture. And in those days in Italy learning was indeed less dominated by priests than in England, France, and Germany. In the ninth century in Salerno we hear of large hospitals under religious, and later under military Orders; and in the Angevin period these institutions had grown very large and wealthy. Some were for pilgrims, some for foundlings; but others were for the sick, and included departments for special diseases—as for diseases of women, for hernia, for eye diseases, and so on. Under the Knightly Orders military medicine became a very important part of the school; and from it issued privileged court and ecclesiastical physicians. Here I may add incidentally that certified midwives also were of its pupils; and in the city were well-known druggists (*stationarii*) and apothecaries (*confectionarii*); for we read that the physicians were forbidden to share any pecuniary profit with these tradesmen. The prices of drugs were governed by two reasonable categories—of those which would keep for a year without detriment, and of those which would spoil more quickly. There were inspectors of the drug-shops, as also for the public health, and against contagion.

In spite then of historical disdain, there was no inconsiderable tradition of learning in the early Middle Ages if not of scientific progress; a little less compendium and a little more practice; pulse and urine were sedulously if not very profoundly examined; the *Consilia* with many interesting marginalia came into use; and lay documents reveal to us much that is curious and picturesque in manners, and much that is precious in the survival and propagation if not in the generation of ideas. In Salerno then from a very early date we find three conditions necessary for a seat of learning: Teachers, Manuscripts, and Colleges.

The search for documents is a very laborious, often a very dull, and generally a very deceptive or elusive industry. Anonymous treatises and treatises passing under false names; several treatises may be concealed in one volume or roll, the writing, crabbed, dirty, or half obliterated; chunks of matter lifted from one writer to another, and needing for their detection a retentive memory and wide reading, treatises uncatalogued and sneezeful with the dust of centuries, treatises of different languages and provenances, and so forth, these tediums and disappointments have discouraged all but the bravest adventurers;

yet those who persevere are from time to time rewarded by nuggets or even by veins of gold. Great then is our debt to Valentine Rose, Ideler, Littré, Daremberg, de Renzi, Diels, Wellmann, and many other ardent scholars among whom, as in private duty bound, I would remember gratefully our sometime Provost of King's, now of Eton. In medical MSS. Italy is of course richest; Paris comes next: in England the Bodleian comes easily first; but happily not a few medical MSS. lie in our own University Library, and in the libraries of Caius, Emmanuel, Trinity, Pembroke, and Corpus Christi.

The closure of the Schools of Athens by Justinian, and about a hundred years later the sack of Alexandria by Omar, plunged Europe under Leo the Isaurian into the Dark Ages. But a remnant remained. Obscure as the beginnings of Salerno may have been, we may presume from the hospitals and other active institutions already mentioned, that an important school was existing there at any rate in the ninth century; certainly in the tenth this school was enjoying a wide and even a venerable reputation, as well as a broad constitution; and it was united with a Collegium of physicians in the city, from which its professors were elected. In the tenth century Salerno was visited by great men from far and near; by a certain Abbot of M. Cassino, afterwards Pope Victor III., and by Robert of Normandy, who remained there a long time for the treatment of a wound. There were also schools of Law and of Philosophy, though none of Theology; and perhaps it was for this reason that the Studium Generale never received the name of a University. Medicine was by far the principal faculty.

That Salerno was a lay school is almost proved by the marriage of the professors, and the eminence of women physicians who, in many cases, were the wives, daughters, or daughters-in-law, of the professors. They were not merely midwives but also lecturers of authority and renown for whom all medicine was their province; even the diseases of the male genital organs were not bowdlerised. One of the most eminent of them was Abella—a lady of the eleventh century—who wrote two works in verse *De atra bile* and *De natura seminis humani.* Astanza Calenda, under Queen Joan of Naples, daughter of a Naples professor, seems to have been a very Portia for beauty and learning.

This celebrated school, the only centre in the West of a high standard of medical teaching on the traditions of the Greeks, a school which flourished even under the Arab revival, and so forward to the new learning and the new Hippocrates and the new Aristotle, was somewhat eclipsed by the foundation of the University of Naples in A.D. 1224; so that in the fourteenth century Petrarch wrote "Fuisse Salerni medicinae fontem fama est, sed nihil est quod non senio exarescat." Nevertheless it survived, if ingloriously, till its flickering life was finally quenched by Napoleon, who cared little for tradition. It is a remarkable instance of a decline of the historical spirit that this great school, and almost the very memory of it, should have fallen into oblivion. Forgotten, or at least unconsidered, its very name had almost ceased among men, when Henschel, the founder, or at any rate the Editor, of *Janus*, discovered in the town library of Breslau a parchment of the twelfth century—that is, of the best age of the Studium Salernitanum—with the superscription of *Herbarius*: this proved to be a *Compendium Salernitanum* containing thirty-five chapters, mostly unedited, and covering a wide ground in medicine and surgery; though few of them were complete. It was in fact a large *Summa*, after the manner of Oribasius, or Aetius, or Paul of Aegina. And, by that remarkable awakening of many scholars about the same time which we see in other fields of knowledge, Baudry de Balzac also, and de Renzi—a wealthy scholar of Naples who afterwards devoted his means to the printing of the documents of the school—were, about 1846, seeking out Salernitan MSS. in Italy, while Daremberg was no less ardent in the same research in France. The outcome of this new activity was a generous collaboration of de Renzi and Daremberg in the production of a "Collectio Salernitana" at Naples, in 1852, in five octavo volumes. And de Renzi published more materials afterwards. Their colleague Baudry de Balzac had died prematurely. It is fair however to the seventeenth century to add, that in 1681 one Mazza had published a *History and Antiquities of Salerno*, in quarto; and a smaller work, which served its modest purpose for the time, was published by Ackermann in 1790.

For some centuries then this noble city, almost solitary in its mission, held up the banner of rational Medicine, not only rescuing the remnants of Greek and Latin treatises, but also reasoning and observing, and much at first hand; its scholars were accomplished both in theory and practice. In the darker ages, before the vogue of scholastic and Arabian medicine, it was a shining example. Its professors wrote in clear and natural language, and described their cases from direct observation. How great the contrast with Medicine in general we perceive by John of Salisbury's (A.D. 1110–80) sarcasms upon the physicians of his day. "They swagger about Hippocrates and Galen, use unheard-of terms and aphorisms, and inflated language . . . they promise everything because they pretend everything—yesterday prentices, masters to-day." The tradition of the surgical skill of the great Greco-Roman surgeons had been almost completely lost, especially in Great Britain. Payne said there was really "no Anglo-Saxon surgery." In Italy and France things were a little better, and the Germanic peoples had at least Yperman and Braunschweig.

Salernitan therapeutics were mainly expectant; and laid a scientific emphasis upon diet and regimen. Their remedies, if far from impeccable, or, especially in the later periods, not devoid of fantastic and even disgusting ingredients, yet on the whole were fairly free from polypharmacy and magic. For instance, in the twelfth century a co-operative treatise was written by the best teachers of the school entitled *De aegritudinum curatione*, which contains nearly every malady as then known. Like all such treatises it commences with the terrible enemy of the age—with the Fevers. These are divided into the Ephemeral, the Hectic, the Putrid—due to infectious juices, and the Intermittent—these last of course being subdivided into the quotidian, the tertian, and the quartan. The rational treatment consisted in baths, cold packs and epithems, and laxatives; to cool the air of the room they said was better than many an internal remedy: but venesection was not forgotten. Then follow the diseases of Respiration; and so forth. Epilepsy is very well dealt with, and so indeed are mental diseases and deliriums. Dropsy of the belly is distinguished from wind by the method of percussion. Deservedly then the school received the name of the Civitas Hippocratica; for it recognised the sanity—the common sense and shrewdness—of the Greek Physicians, their reliance on natural indications, acuté observation and experience, and their wholesome trust in cleanliness and in other natural means of treatment, and in regulation of the conditions, of the sufferer. Even their sick cookery was good ; as for instance their extract of fowl's flesh.

We shall not wonder then that a school of this standard and accomplishment, one comparatively free from the superstitious fogs of the age, was visited by many physicians of distinction from other lands, as by our own Gilbertus Anglicus, by Gilles de Corbeil—a much abler man, and many others. The *Summa medicinae* of Gariopontus, published in 1040, had a great vogue, and must have attracted many disciples to the school. Gilles de Corbeil was a physician of noble family, body physician of Philip Augustus (1180–1223), a medical link between the twelfth and thirteenth centuries, and between the East and the West. He seems to have spent some time in Salerno. He wrote four treatises—*On the Urine, On the Pulse, De virtutibus et laudibus compositorum medicorum*, and on the signs and symptoms of acute diseases ; the manuscripts are now in the Bodleian. Thus then, as Haeser says, Salerno, the Civitas Hippocratica, was in times of violence and discord a sanctuary of medicine where the works and traditions of Greek Medicine were jealously preserved, and turned to good uses.

The surgery of the School was below the standard of the Medicine, and far below Hippocratic surgery ; for this there were some reasons. The Salernitans were indeed skilful "Wundärzte," and dealt with wounds cleverly ; but in operative work they were little skilled. In the Middle Ages operations had fallen into the cruel hands of surgeon-adventurers, hereditary craftsmen, and wandering empirics ; especially of cutters for stone, oculists, operators for hernia, etc. Not only so, but a further reason is that the Hippocratic city did not hold even the medical Hippocratic tradition in its purity ; the school was deeply tinctured with Empiricism and Methodism, influences both against constructive medicine, and against a careful study of anatomy (p. 197). In a former chapter (p. 192) I have given a sketch of Methodism ; I may be content now to reiterate that in its decadence it had reduced all doctrine to the easy notions of *strictum* and *laxum*, so that for the Methodist it mattered little what might be the structure of the part affected, but much whether the pores of it were supposed to be open or closed; for on this artless issue the remedies depended; the interpretation of the process upon the prepossessions and the fancies of the physician. With such notions anatomy became a superfluity. The brilliant anatomy and the physiological methods of Galen had been forgotten; partly no doubt because Galen had been a bitter antagonist of the Methodists, whose writings, preserved, as I have said, in the records of Caelius Aurelianus and others, had rather prevailed in the later schools, and so on to Salerno. It is true that the later Methodists, such as Theodore Priscian (fifth to sixth century), the archiater of Gratian,[1] who wrote in both greek and latin, and transmitted earlier work, much of it excerpts of Pliny and Dioscorides, though professedly methodists, were really more of empirics, and, being against abstract and fine-spun dialectics, so far made for simplicity. At Salerno, it is true, in the lack of apes, some or much anatomy was taught on pigs; yet the comparative neglect of this its foundation degraded medicine not only in the rest of Italy, but also in Gaul, Spain, England, and even Germany; so that the bases of Greco-Latin or neo-Latin medicine were frail and indeed proved to be insufficient, even in Salerno itself, for the vigorous growth of modern medicine. Thus the great surgeon Roger (*c.* 1220), of the later time of Salerno, who wrought a good work in the surgical renaissance of Europe, work upon which the medical renaissance depended, could not rest there. But to follow out the enlargement of anatomical and physiological knowledge in the thirteenth and following centuries would carry us far afield. Suffice it to indicate—what is too well known to need description—that further developments were brought about by the labours of Constantine and Gerard in translations from Eastern sources—at first chiefly Syriac but afterwards Greek;[2] and afterwards by the exuberance of the Arabian schools towards the end of the twelfth century, whose third- and often fourth-hand renderings were in their turn to be superseded by revelations of the Greek Aristotle, and of other original sources. However, before this general reawakening, Arabian or Hellenistic, we see, in the fifty or so of Salernitan works which have come down to us, a gradual enlargement of view. In the works of Trotula, of the Platearii, of Bartholomew, of Cophon, we note a second period, a period not yet Arabian, but yet of re-emergence of Galen and humoralism. We find more allusion to Hippocrates, especially to the Aphorisms, the Prognostics, the Epidemics, and the diet books; to some sixteen works of Galen, to Alexander of Tralles, to Paul of Aegina; the same books indeed with which Paris and Montpellier began. For instance, that celebrated surgeon Roger did not cite Albucasis but Paul himself, whom Albucasis copied; for there is not a little in Roger—*e.g.* on the ligature of arteries—which is not in Albucasis, nor for that matter even in Paul. In this later period then some awakening of a more positively scientific spirit becomes apparent; and of such was Roger's influence upon the succession of great surgeons who followed him, surgery of which I have written in my *Historical Relations of Medicine and Surgery*; such surgeons as Hugo, Theodoric of Bologna, Roland, and Lanfranc, with whom we enter upon the rapid development of later medieval surgery led by William of Salicet, Henry of Mondeville, and Guy of Chauliac. In Medicine unfortunately this positive discipline of surgery was counteracted by the overwhelming Arabian reinforcement of recipe medicine, a kind of therapeutics only too readily encouraged by public and domestic opinion (see FitzPatrick Lect. p. 362).

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[1] *Vide* p. 387; and new Edition by Theodore Meyer.

[2] Some early translations from the greek into the old latin (as distinguished from the latin of the eleventh to thirteenth century) were made in the sixth to eighth century from Dioscorides, Oribasius, Alexander, scraps of "Soranus," etc., but under such pretentious names as Hippocrates and Galen; or, later, "Aristotle." Such translations were revised in Salerno, and by Constantine, Gerard and the Arabs.

It is notable that of the physicians of Salerno, who fought the plague bravely, none seems to have been in orders. Among its later authors I may name Gariopontus, the three Platearii, Cophon, Trotula, and Roger. Gariopontus wrote a *Passionarius*, a compilation drawn largely from a book of excerpts of Alexander of Tralles, and from some old latin translations of Galen, of Caelius Aurelianus, of Priscian, of Paul and so on. Probably a Lombard, he lived in the first half of the eleventh century, and had strong Methodist leanings. The three, or four, Platearii made a great medical family; John, the first of them, wrote a *Practica brevis*, and a treatise on Materia Medica; Matthew Platearius, of the later period of Salerno (end of twelfth century), a work entitled (after its first words) *Circa instans*,[1] a medico-botanical treatise of interest as representing all additions to the science since the time of Pliny and Dioscorides.

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[1] "Circa instans negotium de simplicibus medicinis nostrum versatur propositum," etc. A sort of supplement—largely botanical, from Pliny, Dioscorides, etc.—to the *Antidotarium*; and a mine of greek, latin, and vernacular names. The *Alphita*, a med.-bot. glossary of the thirteenth century, was of Salernitan origin. It was based upon the *Aurea Alexandrina* of earlier repute.

Trotula was probably the wife of John Platearius; if she wrote a quarter of the books attributed to her she must have been a most diligent woman: the best known of them is her *Diseases of Women*, a work rather galenist in temper but by no means free from recipe and charm-medication and, I regret to add, containing far too many prescriptions "ad menstruum provocandum"—that is to say, for abortion. Cophon wrote on pig anatomy, and also an *Ars medendi.* To two more works I may refer for certain points of interest; namely to the *Antidotarium* of Nicholas with glosses of the third Platearius, and the *De medicamentis* of Moses Empiricus. Nicholaus Praepositus—a wealthy and distinguished man and apparently the president of the School at the time, flourished about 1140. His interest for us is that in him for the first time some Arab influence began to appear. This *Antidotarium* was translated into all languages, even into hebrew and arabian; and served as the basis of subsequent works of the kind. Indeed this book, and the *Circa instans* of Matthew Platearius, exercised a dominant influence in their kind until the sixteenth century. In the second half of the thirteenth century another Nicholas, Nicholas of Myrepsus, an Alexandrian, who practised at Nicaea, for his *Dynameron*[1]—a strongly arabianised collection of 2656 recipes in 48 sections—among his various sources copied largely from his namesake of 200 years before; and this compilation he seems to have made at Salerno, in the decadent period. It became a chief school-book of the later Middle Ages, and contained many precious prescriptions, with notes on their virtues; *e.g.* "discovered by the prophet Esdras while an exile in Babylon," and so forth. Yet another Nicholas, one to modern historians better known—Nicholas of Reggio, a teacher at Salerno in the fourteenth century—did the doubtful service of translating Myrepsus' treatise into latin; and a latin version was published by Fuchs at Basel in 1549: later a profusion of editions appeared. The *De medicamentis* of Moses Empiricus was a farrago of scraps of Celsus and Scribonius Largus (p. 371), and of many a later author; he seems to have been a Gaul, probably from Bordeaux, who lived under Theodosius I. and II.; but, worthless as it is for itself, I mention the treatise because, like the *Circa instans*, it has proved of much interest for linguistic interpretation. From the days of Jacob Grimm it has been used as a mine of Celtic words and charms, incidental qualities by which the author has survived in the labours of later generations.

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[1] A kind of name in vogue; as is *Dynamidia*, and later *Dynameus.*

But I may be asked why I have not yet referred to the well-known *Regimen sanitatis*, called later the *Flos medicinae*. This was an anonymous, probably a co-operative, work of the twelfth century. It was in verse, a medium frequently used in those days for didactic works—as even by the great Fracastorio—presumably as helpful to the memory of the students who were unable to provide themselves with books. For even anatomy was put into verse. The *Flos medicinae* was continually tampered with in after times, and loaded with extraneous and unauthentic materials; so that it became a kind of rhapsody, requiring the editorial ingenuity of a Wolff. In its earlier and purer form it contained the essence of Salernitan teaching. Choulant speaks of 141 editions, a number now perhaps to be doubled. Arnold of Villanova was the first editor, of an edition of 3526 verses—with some prose. At that date no Arab influence was to be detected in it, the chief sources being Hippocrates—especially the *De diaeta* ii.—Pliny, Galen (*Temperaments*), and Dioscorides; it was after Arnold that the interpolations became enormous, as for example of excerpts from Macer Floridus,[1] and its original sane Greek common sense was overlaid with fanciful routine and scholastic rubbish. Originally *The Regimen* seems to have been addressed to the public as a tract on Preventive Medicine, "pro conservatione sanitatis totius humani generis perutilissimum"—a genuinely Greek idea. As transmitted to us, it consists of a first Section on Hygiene, 8 chapters; Materia Medica, 4 chapters; Anatomy, 4 chapters; Physiology, 9 chapters; Aetiology, 3 chapters; Semeiotics, 24 chapters; Pathology, 8 chapters; Therapeutics

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[1] Macer Floridus, of uncertain date (tenth to twelfth century), is supposed by Val. Rose to be a pen-name of Otto of Meudon on the Loire, a layman. He may have taken this name in imitation, or in honour, of Aemilius Macer, the contemporary of Virgil and Ovid, known to us only by the passage in the *Tristia* (iv. 10. 43-44):

Saepe suas volucres legit mihi grandior aevo,
Quaeque nocet serpens, quae iuvat herba, Macer.

Macer Floridus compiled 2260 unrhymed hexameters in 77 chapters, *De viribus herbarum*.

On this page are some repetitions of the chapter on Pharmacy, p. 381; but it seems more convenient to leave them undisturbed.

(including baths, diet, venesection), 22 chapters; Nosologia (special pathology), 20 chapters; then *De arte*, 5 chapters; and finally an epilogue. It is full of healthy domestic rules; *e.g.* for rational eating and drinking; fresh air; washing; brushing the teeth, and so forth. An interesting commentary on its contents was delivered by Sir Norman Moore in his Finlayson Lecture, published in the *Glasgow Medical Journal* of April 1908.

In my FitzPatrick Lectures I endeavoured to follow the course of medicine under the Roman Empire, West and East; this sketch of Salerno, for which I make no pretence of original research, I have added in order to link up the fading traditions of the Greek and neo-Latin medicine with the Middle Ages. In this pious work Salerno, emerging conspicuously in the tenth century under its Lombard Counts, with the traditions of culture which I have very imperfectly indicated, played a great part. In 1075, with all South Italy, Salerno fell under the sway of Robert Guiscard; in 1130 it was included in the Kingdom of Naples and Sicily; and under Roger II. flourished abundantly, and indeed continuously, until undermined by the foundation of the Naples University by Frederick. Under the later Emperors it fell into decadence. Even in 1227 a monk of Citeaux—Helinand—quoted by Daremberg—wrote thus ironically: "Ecce quaerunt clerici Parisius [*sic* Dar.; [Parisiis ?] artes liberales, Aureliani auctores [classicos], Bononiae codices, Salerni pyxides, Toleti daemones, et nusquam mores." Notwithstanding Frederick did not kill Salerno, nor probably did he intend to do so; it is said indeed that he founded in Salerno chairs of Arab, Greek, and Hebrew literature. Its name and fame still survived in the fifteenth century, although obviously decayed under Arabian and pseudo-Galenist corruptions. Yet under the Anjou dynasty (thirteenth to fifteenth century) there were at Salerno no less than 120 physicians; and even in 1748 it was still so venerable that it was consulted by the Faculty of Paris, in one of the interminable disputes between itself and the Surgeons. How it was closed by Napoleon on November 29, 1811, I have already stated.

PUBLIC MEDICAL SERVICE AND THE GROWTH OF HOSPITALS

THE LINACRE LECTURE, 1914

MASTER OF ST. JOHN'S, LADIES AND GENTLEMEN—Thomas Linacre, physician and humanist, was born about 1460 and died in 1524. He was Fellow of All Souls, M.D. of Padua, and physician to Henry VIII. That in his day the humanist was as good for the physician as the physician for the humanist I am not prepared to say. In the foundation of the College of Physicians Linacre and his Fellows, after the example of the Faculty of Paris, excluded surgery, not the least fruitful of the organs of Medicine. If of the Renaissance in England there were greater physicians, such, Sir, as William Gilbert of your house of St. John, or Francis Glisson and William Harvey of our house of Gonville and Caius, yet as a forerunner of these, as an interpreter of Greek Medicine in the West, and as a man of rare accomplishment, Linacre holds no unequal place in a great succession.

Now, some four hundred years later, the people of Great Britain have been agitated by a medical revolution, a revolution begun but yet incomplete; namely, by the provisions of the Medical Insurance Act.[1] Like other revolutions this is but a phase of a far wider and deeper movement, a yearning for the accomplishment of a social unity imperfectly compassed by other means, by some means indeed whose virtues in modern times are fading. If for a great society spiritual gifts are both means and end, yet the lesson has been ruthlessly, cruelly, driven home to us that a sound and efficient society must consist in a fabric of bodily health, and be preserved at all points from the dry rot of disease. We have taken a great step forward; but so long as the dependents of the wage-earner are outside it, and so long as the medical aid provided is limited by a primitive machinery, the scheme is incomplete. At this juncture it appears to me, an occasional gleaner in ancient medical history, that a brief review of the public medical services of the Greeks and Romans may have for us something more than an academic interest.

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[1] And since by the establishment of the Ministry of Health.

I anticipate that most of my hearers, even not a few classical scholars, may learn with some surprise how complete a provision of public medical aid was established in ancient times under both Greek and Roman governments and customs. The farther we pierce into the mists of the past the scantier are our records; but some signs there are which seem to tell of such provision even in the beginnings of history. In this lecture, as I propose to occupy your attention with Greek and Roman history almost exclusively, I shall pass by the history of sanitation, remarkable as it may be, in other peoples; for example among the Jews. Looking back then to ancient Greece; in the *Odyssey* when Ulysses, disguised as a beggar, is seated in the hall, and Antinous upbraids Eumaeus for bringing in a guest so disreputable, the herdsman appeals to the custom of entertaining certain wayfarers, especially such as are *δημιοεργοί*, people's craftsmen; and of such he gives as examples, a prophet, a shipwright, a minstrel, or a healer of disease (*Od.* xvii. 383 and xix. 134).[1]

Now of course this allusion does not signify, as it has been taken to signify, that such a medical pilgrim was a public officer, or in any way accredited; as did the shipwright, the prophet, or the minstrel, he travelled for enterprise and reward: still he was regarded as a craftsman of the people, serving the public needs (*τὰ δημόσια ἐργαζόμενος*). Moreover we shall see presently that by a similar title medical officers of more definite place and duty were even then known. But, before descending very far in time, let us see what early evidence there may be of public physicians. An inscription, in Cypriote script upon a brass tablet, was found in or near the site of Idalium in Cyprus. Into the debate upon its precise age I need not enter ; it is generally admitted that it belongs to the middle of the fifth century B.C. This inscription records an agreement between the King Stasicyprus, the Idalians, and a physician named Onasilus. Onasilus and his brothers bound themselves in exchange for certain grants, whether of money or land, to tend without fee the wounded during the siege of Idalium by its neighbours the Citians, and by the Medes. Yet it must be admitted that if it be true that we find a public medical officer bound by stipend to give his services without fee to the wounded, or sick and wounded, we are dealing with an officer appointed under the pressure of a siege. Nay, we may have again to admit that this special appointment goes to suggest, if not to prove, that in ordinary circumstances the city had no official physician. Notwithstanding, we do get so far as this, that to appoint a physician by stipend to a public medical service was at that date a recognised ordinance.

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[1] Mr. Zimmern, in his interesting *Greek Commonwealth*, says the Greeks in their best days did not regard manual work, as such, degrading; he appeals to such monuments as the Parthenon as evidences of the honour paid to fine manual work by craftsmen (*χειροτέχναι*) who wove with hand and brain together. What the Greek regarded as menial was monotonous labour, from which the joy had gone out. *E.g.* see Xenophon, *Oe.* 4. 2. Surgery was not divorced from medicine and subjected to it until the second century A.D. The utter severance of surgery was really the work of the University of Paris. (See C. A., *Hist. Relations of Medicine and Surgery.*)

We shall find more light upon this subject when we turn to the familiar story of Democedes of Croton as narrated in the third book (ch. 131) of Herodotus.[1] The part of the story which concerns us is that Democedes engaged himself to the State of Aegina at the price of one talent a year ; then to Athens at a hundred minae, and after that to Samos at two talents. At that time, says Herodotus, the physicians of Croton had the name of being the best, and those of Cyrene the next best, in all Greece. Herodotus then speaks of public medical officers as a well-known institution in the cities of Greece at the close of the sixth century B.C. Dr. Budge says, in his *Syrian Medicine* (p. 143), that under the ancient Egyptian Empire the place of the physician was one of great influence and dignity.

Furthermore, Diodorus quotes, from the Sicilian Timaeus, certain laws of Charondas the Catanian in which it was enacted that all private persons should have a right to free treatment from a public medical officer. I will not enter into the controversy concerning Charondas and the laws of the Thurii, a colony on the peninsula near Tarentum, a controversy in which the invulnerable Bentley was engaged ; I may be content to say that certainly in the fifth, and perhaps in the sixth, century B.C. public medical officers were appointed also in the cities of Sicily and Magna Graecia. Hence it is no extravagant assumption to suppose that such officers were appointed in all chief cities of Greece and its provinces. Besides midwives (*μαῖαι*) there were many women doctors (pp. 218 and 433); inscriptions mention such women, as *ἰατρός* or *ἰατρίνη*; but whether in public office or not we cannot say. (By the way two male doctors are spoken of as *μαῖοι*.)

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[1] May I here, once for all, acknowledge my debt to the excellent little books, *De Graecorum medicis publicis*, R. Sc. Pohl, Berlin, 1905 (the author's latin might be bettered), and Theo. Meyer, *Gesch. d. römischen Arztezustandes*, Kiel, 1907. Milloux, *Essai sur la méd. offic. de l'antiquité grèco-latine*, Thèse Bordeaux, 1903, is superficial and contains many errors.

As we descend the stream of time we find ourselves in the fuller light of common knowledge. In the sixth or fifth century our records are scanty; by the fourth the public medical officer had become a common institution throughout Hellas. In the play of the *Acharnians* (l. 1030) the pacifist Dicaeopolis cries out, "But, you rascal, I am not a public doctor (*οὐ δημοσιεύων τυγχάνω*); go and complain to Pittalus." So again (l. 1222) the warrior Lamachus is told to betake himself to Pittalus. If also we turn to the *Wasps* (l. 1432) we find that Philocleon advises the wounded man to repair to Pittalus. Thus we learn that in the beginning of the fourth century the public medical officer was an institution so well known as to lend itself to the vernacular of comedy; and that of such persons Pittalus was prominent enough to point a topical allusion. From this time onwards, as our witnesses increase in number, we meet both in literature, as in Plato and Xenophon, and in inscriptions, with more and more of these incidental allusions to public medical officers. Moreover, the evidence of inscriptions, it is said of at least a thousand extant, gives us the pleasant impression that these officers were frequently held in honour, and at their death or departure affectionately regretted; thus, for instance, early in the second century B.C. we have the inscribed Resolution of Amphissa in honour of Menophas, son of Artemidorus of the Hyrcanian city of Lydia, who was summoned as public physician to Amphissa. Many of these inscriptions are upon the pedestals of statues erected in honour of such officers; some are votive, others sepulchral. In the *Monumenti Antichi* of the Lincei (1915) is a fifty-line inscription, a panegyric of one Asclepiades, son of Myron, set up perhaps by his family; still it shows the custom; as again in the inscription of the Agoni Medici of Ephesus (Keil, *Jahreshefte*, 1905, 125) Pheidias of Rhodes is thanked by the Athenians

(Dittenberger,[1] *Sylloge* 489); and (*ib.* 490) a Cos inscription of the third century B.C. to the honour of Xenotimos, also in time of plague. Better known is the blue marble slab of *Carpathos*, now in the British Museum (No. ccclxiv.), inscribed to the zeal and noble ambition of Menocritus, son of Metrodorus, a Samian. He had laboured for the public weal, both of citizens and strangers; and did not shrink from his duties in time of pestilence. He was honoured at the Games by the gift of a golden crown. He is said to have had no salary and to have lived in poverty. These three monuments (to which I was referred by my friend Mr. W. H. S. Jones) speak of devoted service, to poor as well as rich, in times of stress. They may therefore be exceptional evidence. Still the large number extant of these medical honorific inscriptions[1] points to a prevalent esteem.

In the fourth century it is certain, not only that public medical officers were universal in the Greek cities, but also that thence the custom spread to the βάρβαροι. In Marseilles we find that as of teachers (σοφισταί) some were in public pay (πόλεως κοινῇ μισθούμενοι) while others were occupied in private practice (τοὺς μὲν ἰδίᾳ), so it was with certain physicians (καθάπερ καὶ ἰατροί). We learn from Diodorus (xii. 1. 62) that in very early times in Rome physicians received salaries from the State.

The title of the public medical officer, as we have seen, was ὁ δημοσιεύων ἰατρός—the public doctor.[2] So we read likewise in Coan documents, and generally elsewhere, including Greek Egypt. Often the word ἰατρός was omitted, as we have seen in the *Acharnians*, and the word δημοσιεύων or ὁ δημόσιος—the people's practitioner—was used alone; or again simply ἰατρός, or ὁ ἰατρός.[3] On inscriptions at Athens and elsewhere, ὁ ἰατρός, *the* physician—is used alone. So the word δημοσιεύειν also expressed the public medical function; whereby it would seem that the doctor was the chief, or best-known, of the public experts. Frequently he is found in honourable association with the city architect; the architect and the doctor being κατ' ἐξοχήν *demiurgi*. As the public physician seems to have been concerned with drainage and water-supply his relations with the city architect would naturally be intimate. A fine example of such co-operation we seem to have before us in the great sanitary and hydraulic works in prehistoric Crete.

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[1] To be found in Newton; in Paton and Hicks; in Herzog. *Arch. Anz.*, 1903; in Homolle's various articles, etc. etc.

[2] From δήμιος, public, as opposed to ἴδιος; not directly from δῆμος, people. "The people's doctor" is incorrect.

[3] The profession of medicine was usually known as τέχνη (the art) (as in Hipp. tr. Περὶ τέχνης), or ἰατρικὸν ἔργον (the healing business): *e.g.* τὸ δημόσιον ἰατρικὸν ἔργον; or the word ἐμπειρία may come in. But we read also of medical science (ἰατρικὴ ἐπιστήμη).

The manner of electing these medical officers (*δημοσίᾳ χειροτονούμενοι ἰατροί*) seems clearly indicated. A city having a vacancy for a public physician, was wont, by letter or embassy, to invite a well-known practitioner from elsewhere to settle in the city, making him a certain offer of reward. Cos seems to have been, as we might suppose, a source whence capable physicians were distributed, often to far countries. Or, at other times when doctors were less scarce, some of them would compete for these posts; or a physician would settle in a city or district and win his way by gratuitous services. Thus one Apollonius, a Milesian, when he heard that the plague had broken out at Tenos, before he was appointed public medical officer, went thither and practised for six months without receiving any fee. From Plato (*Gorgias* 455 B) we learn that at Athens the public physicians (and other *demiurgi*) were elected by an assembly (*ecclesia*), but by what assembly is not stated in this context; however we learn from an inscription that the public architect was elected by the popular comitia (*in comitiis populi*), and, as I have said, public architect and public doctor ran on similar and associated lines. Some treatises which have come down to us may well be examples of public "Addresses," such as were often delivered by physicians when seeking election to a medical service, or on entering upon it (p. 471). We know that competitive Addresses were delivered in Ephesus.[1] It is clear that great care was given to the election of the public physician, and that it was decided solely by merit, as merit was understood; a foreigner, at any rate in earlier times, had at least as good a chance as a native, but then his election did not carry with it the freedom of the city. A Jew was a district physician in Ephesus and again in Venusia; many of the public doctors were Christians. In later times it was more usual to elect a citizen, or even to make the office hereditary. The defect of any standard of qualification however must have made municipal selection difficult. We find that Antoninus Pius restricted the too large immunities granted to all medical practitioners by Hadrian ; but this did not meet the difficulty. How was *medicus* to be defined ? What (under Alex. Severus) was a *medicus a republica probatus* ? Municipal approval was required at least to the end of the fourth century. In Galen's time lectures on Medicine were given in the Temple of Peace (Kühn xix. 21). Later both Emperors of the name of Severus did good service in extending and organising medical education in Rome by establishing salaried lectureships (as also for other faculties). The medical lecturers were to be *moribus et facundia idonei*[1] and we have evidence that in this period (end of fourth century) the Hippocratic ethic had returned, and bedside teaching improved in kind and weight. Under Severus we read of the public physician "honeste obsequi tenuioribus maluit quam turpiter servire divitibus" (as in the first century) ; and so under Valentinian, Valens and Gratian his distinction and honour lay in his service to the poor, a devotion in part at least to be attributed to Christianity. We find on a certain inscription that a public physician received the freedom of his city as a reward for his devoted service in a time of peril, in such cases often gratuitous (*ἄνευ μισθοῦ*). From Homeric to Hippocratean and Alexandrian times we find that the calling of medicine continued in high esteem. Some physicians were Areopagites ; others held such titles as Proxenus, or Euergetes ; or received the freedom of a city. To others golden crowns (*e.g.* Artemidorus, *I. Gr.* xii. 719), and decorations (*ornamenta*), were voted ; or memorial statues (even of ivory) erected. Grateful inscriptions are frequently met with, *vide* Oehler.[2] That in Rome medicine fell into some disrepute was due in part to Roman intellectual stupidity, and yet more to the kind of hungry Greek who flocked to Rome in the later Republic. Later again, in Rome, we know that Julius Caesar granted the freedom to all physicians, public or private, and to this boon Augustus added certain considerable immunities. From the time of Augustus onwards—Augustus was the first emperor to vindicate for them their due place—physicians in Rome rose into still higher repute.

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[1] See H. Wagner, on a pseudo-Galenic tract or Address, reviewed by myself in *Class. Rev.*, May 1915. On Competitive Addresses H. W. refers to I. Keil, *Jhfte. d. österr. arch. Inst. Wien*, Bd. viii., 1905. See p. 471.

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[1] As for graduation as M.D. in Cambridge at this day, we warrant the candidate to be "tam moribus quam doctrina idoneus."

[2] J. Oehler, "Epigraph. Beiträge z. Gesch. d. Ärztestandes," *Janus*, 1909, vol. xiv. H. 23-9, contains much valuable matter. See also H. Barnes, "Roman Medical Inscriptions in Britain," *Proc. R. Soc. Med.* vol. vii. 1914.

Indeed his own physician, Musa (p. 212), by his merits did much to raise the profession in public esteem. In this period, and later, we find valuable immunities and exemptions granted to the practitioners of medicine; relief from taxes and from the burdens of public office (*ἀτέλεια*), and, for not a few, high places at Court. These privileges were increased by Vespasian, A. Severus, and even Diocletian. Vindicianus was a proconsul in Africa, and Ausonius—father of the poet—Prefect of Illyria. It is notable also that when similar privileges were withdrawn from the sophists and other teachers, the physicians were not thus deposed. The favours of Julius and Augustus were due in part no doubt to the needs of the army; but also to the higher class of Greek physician practising in Rome, no longer merely slaves, freedmen, or menials, but skilful and responsible men; and again to the high distinctions and more definite status of physicians in the Greek provinces—*e.g.* in Marseilles. In still later Roman times, certainly in the time of Hadrian and the Antonines, in many provinces if not in all, the public physician, though elected by the city, had to be approved by the proconsul, prefect, or other magistrate. In Marseilles, in 30 B.C., the municipality was selecting its own physicians, and the rule spread in Gaul. The provinces were responsible, at any rate in part, for their stipends. In no period of ancient history however was any State recognition or approval required for the practice of medicine; medical practice was open to all, and charlatans and mobs of professing specialists abounded. When certain ratifications are spoken of, as of *οἱ δεδοκιμασμένοι*—those recognised in contrast with other doctors, it was in this sense only that they were approved, by the prefect or other magistrate, as public officials. Indeed, to digress into later times, in and after the reign of Diocletian the subject cities, with the rest of their liberties, lost that of electing their public physicians. Such appointments were then made at Rome, and the title of Archiater, a title to which I will refer again and more fully (p. 456), came into wider use. Under the Empire the post of a public physician was often a life appointment; in earlier times these officers were more unsettled; they would migrate as they received more tempting invitations from other and richer cities, or were besought to return to their native place.

Of the numbers of public physicians in the several cities we have no definite knowledge, not at any rate in the earlier periods; the number would depend on the size of the city; and these numbers rapidly increased after the fifth century B.C. It seems certain however that in the last two or three centuries B.C. Athens had many of these officers, perhaps six or eight. They are spoken of in the plural as ἰατροί; for instance, according to a certain inscription, those physicians who serve the public (ὅσοι δημοσιεύουσιν) sacrifice together to Asclepius; and so on. But no definite number is mentioned. On a marble slab, found in Athens in 1876, six persons are figured who, in Pohl's opinion, represent six public physicians: he surmises that they may have been members of a college. It seems at least that in certain civic functions the public medical officers of Athens acted together; and we find in the greater cities occasional records of medical guilds, or colleges; especially that of Cos. In Roman times we hear still more definitely of such corporations; as in Wood's *Ephesus* (quoted Pohl) of a synod of Ephesian physicians. Also from a reprint of a paper from *K. K. Österreich. Arch. Inst.* viii. S. 128 (1904) we have learnt more of this Ephesian guild; that it devoted its energies to advance the science of medicine and the standing of the profession; and gave prizes for good work in surgery, dietetics, and therapeutics. Even archiaters competed in these lists, a title which in Ephesus was applied to public physicians only. We learn also that at this period in Ephesus there was a Museum of Science, organised, as were museums in other cities, on the Alexandrian model. The meetings of the medical guild were held in the Museum.[1] There was a college of physicians on the Esquiline Hill. An inscription at Beneventum relates to the property of a medical college (*schola*)—"in perpetuum ad collegium medicorum pertinet." We read also of a "scriba medicorum," the college secretary. For example cf. Orelli 4226, quoted Meyer: M. LIVIO CELSO TABULARIO SCHOLAE MEDICORUM M. LIVIUS EUTYCHOS ARCHIATROS

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[1] It can scarcely be said that there was any systematic qualification of medical men, by ordinances, examinations and diplomas, licences and penalties, before the "Magna Charta of Medicine" at Salerno (*e.g.* Ordinance of Roger, 1140). The cynic may retort with too much truth that in spite of Salerno, and many similar edicts later—*e.g.* of Philip the Fair in the thirteenth century—quackery, and villainous quackery, was perpetually rampant. It is fair to add that both emperors of the name of Severus did much to organise medical education by the foundation of paid lecturers (and in other callings)—*moribus et facundia idonei*; and at this time clinical teaching was certainly active. In Galen's time lectures on medicine were given in the Temple of Peace (xix. 21), but Athens maintained her academic reputation.

OLL. D. II IN FR. PED. IIII. And again: D. T. AURELIUS M. TELESPHORUS SCRIBA MEDICORUM [*C.I.L.* vi. 9566]. In the absence of qualifications or diplomas these colleges no doubt did much to keep up a standard of proficiency and honesty. The earlier medical guilds in Rome, as under the Republic, had, like our Corpus Christi guilds, more of a religious character than under the Empire. Even in the second century A.D. there was a medical guild at Turin for the worship of Asclepius and Hygieia; thus: DIVO TRAJAN. C. QUINTIUS ABASCANTIUS TEST. LEG. MEDICIS TAUR. CULTOR ASCLEPI ET HYGIAE. As these colleges, medical and other, became covert political centres they were placed under licence. Of teaching by demosii we have no evidence.

That at Cos there were many physicians we have already noted; and of these some were public officers. We shall bear in mind that Cos, a fertile land and a busy centre of trade, was celebrated not only as a medical school but also as a health resort. On an inscription of Cos (Paton and Hicks: quoted Pohl, p. 19, No. 7, see also other quotations on same page), an honour is recorded to a private physician who during an epidemic came to the assistance of the public medical officers, who were evidently not a few. A decree of Antoninus Pius fixed the number for large cities at seven to ten (as also of grammarians, sophists etc.). Incidentally, let me note that we find no record of any rivalry between the public and the private practitioners; though Plato (*Laws* 720) draws a vivid contrast between the manners and methods of practice among gentlefolks and those of what we used to call "Club practice." In the island and district of Cos there were public physicians, not in the larger centres only, but also in the villages; presumably this was the case everywhere, at any rate in the Greco-Ionian region.

It is convenient here to remember that besides ordinary medical practice there were other medical posts of a public kind: such as the medical officers of the public schools—often life appointments (*διὰ βίου*); of the actors—a large company; of the gymnasiums; of the gladiatorial school—a post which Galen filled for a time; those who attended at Olympia, and so on. The fees seem to have been honorary; some doctors, not of the better ranks, contracted for a cure. The large colleges, or guilds in Rome—the Smiths and the Potters for instance (Oehler, *loc. cit.*) —had their physicians ("medici Collegii fabrum," etc. and

"Coll. Aescul. et Hygiae"), as they had their secretary and, like the later Corpus Christi and other societies, their priest; and we find mention, on inscriptions, of a physician to the Gardens of Sallust, of the "medicus de Lucilianis," and "e Bibliothecis." It seems, moreover, from some inscriptions that the Council (*βουλή, γερουσία*) had its medical officer; *e.g.* Ἑρμῆς ἰατρὸς γερουσίας; and so presumably had other associations, public and private. That there were army and navy doctors we know well. But in what relation, if any, the holders of these official posts stood to the people's physicians we have no notion; probably none.

Of the payments by salary and fee to the public medical officers we have some information, but not on all points. It seems probable that these officers were bound to attend all citizens, whether poor or rich, without fee. We have seen in the *Acharnians* not that the poor husbandman only but also the distinguished soldier Lamachus was to be carried to the public doctor.[1] And in the ordinances of another city we read (Pohl p. 57) that the public physician shall give prompt and kindly aid equally to all, whether poor or rich, bond or free. And, in Athens at any rate, resident aliens (*μέτοικοι*) were likewise entitled to this officer's services. Moreover the public medical officers acted, when required, as assessors to the magistrates. It does not appear however, at any rate not before the equivocal "archiaters" of the later Empire, that the public medical officer had any precedence before the private physician.

As regards salary, we have seen in the passage of Herodotus concerning Democedes that in Aegina it was at the rate of one talent yearly (say about £250); in Athens 100 minae (60 minae made a talent), in Samos two talents. These seem to have been exceptionally large stipends, offered to a man of great reputation. Concerning Onasilus and his brothers, whose agreement with the Idalians I have mentioned, we find that to them a talent was offered; or, alternatively, a certain cultivated and well-stocked plot of land in perpetuity. To Onasilus himself certain further payments in money or land were made. The doctors preferred to take the land. But here again in an hour of peril the terms offered were no doubt, for such early times, extraordinary, and, as in the case of Democedes, were recorded because extraordinary. From what may be gathered here and there in later records it seems likely that the ordinary annual stipend was about 500-700 drachmas; with fifty more for a house if this were not found. One Philippus of Cos from Cretan Aptera had 300 staters travelling money. In bad times the stipends fell off, and with them, I fear, the public spirit of the doctors; for we read in the *Plutus* (407) that as when Athens was in straits the pay was nothing, so the craft was nothing.

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[1] On this passage Dr. Heitland kindly reminded me that Lamachus was a poor man. When he went out in command he had a grant for his personal outfit (Plut. *Nic.* 15). And Aristophanes hints that he was for war because he might thus draw pay. Mr. W. H. S. Jones thinks from *Acharn.* 1030 that the State doctor could not take a fee (*προῖκα ἐθεράπευον*).

> *τίς δῆτ᾽ ἰατρός ἐστι νῦν ἐν τῇ πόλει;*
> *οὔτε γὰρ ὁ μισθὸς οὐδὲν ἔτ᾽ ἔστ᾽ οὔθ᾽ ἡ τέχνη.*

Let us hope this was Aristophanes' fun.

Notwithstanding his public responsibilities, it seems probable, though not certain, that the public medical officer was permitted to receive fees from the wealthier patients, and that the office was sought after for this reason. In the Code of Khammurabi the fee for a serious operation was 10 shekels—roughly about twelve shillings. If in an operation the surgeon should damage a slave he was to replace him by another; or, if not wholly spoilt, pay half his value (Budge, *loc. cit.* i. clxxiii). The Lex Cornelia (88 B.C.) made the physician liable to arrest in case of death alleged to have been brought about by his fault. Of the sophists we know that, although some were paid by the State, these, or others of them, received also enormous fees from the public. However the acceptance of fees, and the relation in this and other respects of the public and the private physician, still remain very obscure. At a later date, we find it laid down in the *Cod. Just.* (x. 53. 9, quoted Pohl) that the public physician "shall choose rather to do honest service for the poorest than to be disgracefully subservient to the rich"; a return to the ethics of Hippocrates. The ordinary fee in Rome for a medical visit seems to have been about fifteen pence of our money; but Erasistratus for curing Antiochus received 100 Attic talents—say about £24,375.

The public stipend was, at any rate in some cities, raised by a special poll-tax (*ἰατρικόν*), either in money or kind; we have records of this in Teos and Delphi. Besides, as I have said, medical officers who had deserved well of the city received honourable distinctions, such as wreaths, memorial tablets, freedom of the city, or other immunity. Such honours were bestowed, for instance, when a popular physician moved away to another place. Nevertheless we find that some physicians invested with the freedom rose to high dignities in the same city. The oldest of these is a portrait tablet in Athens to one Aineios, great-uncle of Hippocrates (*c.* 584 B.C.); the latest in Verona to one Petros, A.D. 511. In some cases indeed a hereditary freedom was bestowed; and father, son, and son's son succeeded to the public office. In the time of Greek supremacy at least the claims of a candidate for the post of public physician were much strengthened if father or grandfather had efficiently discharged its duties. We know, for example, that at Cos and elsewhere medical families developed into schools or guilds, both by family succession and by apprenticeship. Thus it was that Cos became a sort of medical university, where every candidate (τέχνης μαθητής) learnt of his "Master" who presumably taught in his surgery (ἰατρεῖον). In Alexandria and Laodicea there had been Herophilean Schools (διδασκαλεῖαι Ἡροφιλείων ἰατρῶν, and in Smyrna an Erasistratean (τῶν Ἐρασιστρατείων) (p. 162); doubtless such institutes persisted from generation to generation. Later, under the Roman Empire, we know that a medical curriculum was formulated, and that it included rhetoric and mathematics. Special training was then given for the public medical service. The iatrosophists gave lectures after the manner of those of the other sophists.

Town Planning.—This provision goes at least as far back as Hippodamus of Miletus, a compatriot of Anaximander. He had a great reputation as a city architect; he laid out Peiraeus—the port of Athens, Thurii, and Rhodes. Instead of narrow, crooked streets and irregular openings he designed broader streets, crossing each other at right angles, and oriented to sun and air. This design was adopted in all later cities down to Rome and Pompeii. He laid down also municipal divisions of land and of citizens, and some legal systems.[1]

Water Supply.—Enormous pains were taken from early times to secure its abundance and purity, a provision neglected in modern times until the middle of the last century, and even yet in many districts by no means what it should be. We have a treatise *De aquaeductibus* by Frontinus, Water Surveyor under Nerva. The Appian aqueduct was only eleven miles long, and was underground, probably for security against raids. For a larger supply Frontinus went forty-two miles—to the Anio, also by a subterranean channel. These two sufficed for 120 years. Then six or seven aqueducts were built on arches, so that probably more than 300 gallons per head per day were supplied! Piscinae or settling reservoirs were provided. And all the cities of the Empire had some such liberal provision; as we see at Nismes. Corfield investigated and described the ancient supply of Lyons. This city being on a hill was not easy to serve, but a source was found at Mont d'Or. Hofmann of Graz [1] (the paper itself I have been unable to obtain) has collected with care and completeness the observations of ancient physicians on the qualities of water—to sight, smell, taste, etc.; the last two sections are on baths and diet.

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[1] See Diels, "Wissensch. u. Technik b. d. Hellenen" *N. Jahrb. f. d. klass. Altertum*, 1914, xxxiii.

It seems desirable here to advert to the significations of the title of *Archiater*, or Arch-physician.[2] This title, apparently in existence before the Christian era though not mentioned by Pliny, was of oriental origin: probably it arose, at any rate got its vogue, in Syria under the Seleucids in Antioch. At first, as with other titles, so with that of Archiater, the signification was indefinite, and defined itself later; for in two inscriptions from the *Columbarium Liviae* on the Appian Way we read of a "Supra-medicus" and of a "Decurio medicorum." Such a title as Archiater however could not but "catch on," especially later in the ceremonial hierarchy of Byzantium; Constantine defined the title of Archiater as of an official with some episcopal powers over the doctors of the Emperor's person and of the palace (med. palatinus, medicus scutatorium ("bodyguard") (Amm. Marc.) etc.), and perhaps over others in the city, though with no precedence in the provinces; and gradually from the fourth century in the Lower Empire, especially in the Eastern, it became more and more formal in its application, *e.g.* the Archiater Sacri Palatii of the fourth to fifth century. For these court doctors, as with us for the title "Aide-de-camp," that of Archiater meant something different from its ordinary use. But under the Western Roman dominion the title seems to have been one of less consideration, and to have attached itself more particularly to the public or "district" physicians (Archiater *πόλεως*); thus, in A.D. 373, Valentinian appointed an "Archiater" for each of the fourteen districts of the city; but this designation denoted no control over the profession. We learn indeed from one inscription that there was in Rome a College of the Archiatri, but this may have been no more than a college of the district medical officers. The title may have become more and more confined to the physicians of the Court, or been given to any physician of distinction; especially to one who superintended others, or held any considerable public office. As, in the time of Domitian at any rate, the Emperor's body physician was known not yet as Archiater, but as "medicus Augusti" (*ἰατρὸς Σεβαστοῦ*), it is curious to find Galen speaking of Nero's physician, Andromachus, as Archiater; Schonack says he was the first to be so designated; this may have been the first formal use of it. But I suspect this title was either a casual affectation of Galen who, as a Greek of Asia Minor, fancied Greek terms, or of Nero himself; so that the title may have been merely personal to Andromachus. C. Stertinius Xenophon at Rome was not designated Archiater, but the more Eastern Coans thus addressed him. And so the Greek doctors ran the title in Rome. It seems never to have been used in Athens, though certainly there were district doctors there. A like explanation may be given of Galen's lax use of the title in some other contexts. I find in Marquardt that in the later Empire the title of Archiater "grew up" so widely that it was applied to any doctor in chief who directed "submedicos" in large establishments, as in the Gymnasia or the House of the Vestals. Probably for the big men the title was glorified by the appellation of "Spectabilis" or "Perfectissimus." The Merovingian and Carolingian kings had their Archiaters; and Dr. Withington has pointed out that the title was continued by the Popes; Guy of Chauliac was Archiater to Clement VI. at Avignon; I am told that an Archiatria Pontifica still exists. It is alleged that a College of Archiaters appeared, which examined medical candidates in some way—

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[1] Hofmann, *Wiener Akad. Abh. phil.-hist. Kl.* Bd. 164, Abh. 2. S. 69, and Bd. 165, Abh. 3. S. 38, Wien, 1909–10.

[2] See Pohl (*loc. cit.*) and Wellmann in Pauly-Wissowa, art. Archiatros.

e.g. at Ravenna ? ; and that these after approval were entitled to take pupils. But all this is very uncertain. In early medieval times, that is to say about the eighth to ninth century, the word archiater drifted into vulgar use, to signify any doctor, perhaps as a complimentary mode of address ; and so, curiously enough, overflowing Roman limits, it spread into Germany and became contracted into the familiar German " Arzt."

Surgeries.—Every public physician had what we may call his surgery (*ἰατρεῖον*) ; in many cases the surgery was provided by the city. When Plato (*Rep.* iii. 405) says that in times of disorder and disease many law courts and surgeries were opened (*δικαστήριά τε καὶ ἰατρεῖα πολλὰ ἀνοίγεται*) the meaning presumably is, for the surgeries as for the law courts, that both were public offices. Albeit every surgery, whether private venture or subsidised institute, went under the name, and was under the management, of a particular physician. To these surgeries I invite your attention, as out of them probably arose the hospital for the sick. In most cases the surgery was an apartment of the physician's residence, but so placed as to have convenient access from the street.[1] We learn moreover that, as Hippocrates counselled, and as Vitruvius practised, it was carefully planned in respect of air and light, and of an abundant water-supply. The so-called " surgeon's house " at Pompeii, in which many surgical instruments were found, may have been an example of the surgery of a public medical officer. Among the contents were pots for drugs and ointments, cupping instruments, bougies, specula of all kinds, syringes, sponges, bandages, and a large variety of instruments, many for specialist uses. In the Hippocratic collection is a book entitled *Κατ᾽ ἰητρεῖον*, and, from a commentary of Galen upon it, we learn that such surgeries, especially those of municipal provision, were often very large and commodious apartments. A certain vase-picture is extant[2] of such a " clinique " in some city—probably Athens. Five patients are in attendance, four of whom are leaning on sticks. The physician is seated, and is bandaging a man's arm. An attendant is present, and surgical appliances are lying around.

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[1] The article on *Ἰητρεῖον* in *Hermes*, xxiii. is chiefly concerned with MSS. and text revision. The Hippocratic treatise so named is considered to be an unfinished sketch, hurried and unrevised.

[2] Pottier, *Mon. et Mém. de l'Acad. de Paris.*

One man is carrying a hare which Pottier suggests may be a present for the physician. Now it is probable, although the surgery (*ἰατρεῖον*) was chiefly for out-patient practice yet that, even from the fourth century onwards, patients in case of urgency were received indoors; in case, for instance, of a serious operation, or of illnesses requiring close attention and special appliances such as baths, or too severe for the patient to go to and fro. The *locus classicus* in this respect is a passage in the *Menaechmi* (v. 5. 45) where the Medicus advises that a certain madman should be taken by no less than four attendants to his house where he has special provision for lunatics, and where he will make him drink hellebore for twenty days. The Medicus accordingly goes home to make preparations for the patient's reception. We have other allusions of a similar kind, even from the fourth to third century B.C. Under the Empire the evidence of the reception of indoor patients on a large and systematic scale becomes stronger and more definite; and we learn that baths, massage, and such means were instituted therein. Even before our era some of these surgeries, especially no doubt those provided by the public, were so large as to be outside of, if still near to, the doctor's residence; and were manned with assistants, pupils, and slaves (*vide* Aeschines, *In Timarch.* 40). That Lamachus was to be taken to a surgery we have already observed. Furthermore, from inscriptions and otherwise, we learn also that specialists such as *medici ocularii* and *auricularii*, had offices in Rome.

Of *schools of medicine* in Greece and Hellenistic countries I have spoken in the FitzPatrick Lectures. The first medical schools we know of in Rome were established by Alexander Severus. Professors and other teachers were provided, and students, who paid fees, were attached to them as pupils or apprentices. But there seems to have been no hospital clinical teaching, no systematic curriculum, and no compulsion. I find no evidence of teaching by the State physicians.

Hospitals.—Thus it seems to have been in respect of public medical service; that throughout the countries of Greece and Rome, so far in the past as our records carry us, the public provision for the care of the sick and needy, which in modern Europe has been sadly neglected, was then universal. In respect of hospitals in modern times our honour stands higher. Their origin in ancient times we may now trace through the surgeries (p. 458), the temples, the valetudinaria, and the military hospitals.

It is generally assumed, even in formal histories, that this mode of charity originated with the Christian Church, or at any rate in Christian society; and began not much earlier than the third or fourth century A.D.

Let us consider then what is meant in this respect by the quality of charity. We have seen that long before the Christian era houses or apartments for the sick were in existence; this is too well known to need more argument. What then is to be regarded in this context as "charity"? Is a sick ward in a Workhouse, or a modern municipal "Sick Asylum," a charity? It is, if reception without payment in the case of the poor be the criterion. On the continent of Europe hospitals for the sick are supported by public funds, but none the less would they be claimed as charitable institutions. If it be said that the Roman valetudinarium for slaves was not a charitable institution, because it was less for the relief of the slave than of his master, what then of the footmen and ladies' maids in St. George's Hospital in London?[1] I suppose that the quality which we are seeking as a criterion is pity? Was pity for the sick, as a working sentiment, practically unfelt, unrealised, or at any rate unsystematised, before Christ? I have discussed this subject with my friend Mr. W. H. S. Jones of St. Catharine's College, who, after pointing out some touching evidence of the care of the sick in many nations, even the least civilised, and the proofs of such words as ἔλεος, οἶκτος, *misericordia*, and many passages in the *Iliad*, in the Greek dramatists, and, later, such rays of light as Virgil's "lacrimae rerum," thinks notwithstanding that before Christ compassion was, it is true, a virtue; it was καλόν; but not till after Christ did it become a duty (δέον). He dwells however, as I have done, on the evidence that many at least of the Greek states provided medical aid for their sick poor, and that every disabled person in Athens whose yearly income was less than three minae, received a pension of an obol a day. And we may reflect upon the further evidence of universal and systematic public provision for the sick already laid before you; and also to the memorials erected to physicians who had performed their duties with kindliness and efficiency. Compassion and pity, as Mr. Jones says, are instinctive in human nature, and are found at all times and in all places; we know, for instance, how deeply Cicero was moved by his domestic affections; this is true, but machinery may be long in the making; meanwhile Mr. Jones says generally that much Roman legislation (*e.g.* of Tiberius Gracchus) was due to a genuine desire to alleviate misery.

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[1] Cato sold his old slaves, as some people sell their old horses (Plut. *C.M.* 4). It was at a later date that sick slaves were sent to the Aesculapian Island.

The humane spirit in those days was in course of early evolution; it was moving under half lights; feelings unrecognised, or recognised only as novel and intrusive elements to be tested, and until put to the test mistrusted, were budding. Yet although thus treated dubiously, or by some even disdainfully, they were silently penetrating into the active offices of men, and guiding them better than they knew, or pretended altogether to approve. Many yielded if without assent. Again, the difference of the structure of Roman and Romano-Greek society from that of our own, a difference especially in the institution of slavery, makes it less easy to compare the several social constituents and faculties in ancient and modern life. The social classes, if such classes—other than of freemen and slaves—could be said to exist, were different from our classes of upper, middle, and lower; and charitable institutions, if any, would run on other lines. But perhaps I need not labour this part of my paper; I may be permitted to assume, from what we know of the temper of a century or two before Christ, that, partly politically or socially, partly sympathetically, the provision of hospitals, or of institutions virtually hospitals, for the relief of the poor, or the advantage of the affluent, would be not incredible. Nay, we may appeal to times still more ancient: Clement of Alexandria testifies that upon the portal of the temple at Epidaurus was the following inscription: "It is meet for him who enters the temple to be pure; now to be pure is to have holy thoughts."[1] That is to say, the ceremonial purification required of every visitor was not sufficient; an indication surely of some prophecy of the teaching of Christ. On the other hand, the obscurity of the records on the reception or conditions of reception of the sick under medical supervision is very perplexing; the details which we desire to know are, as it were by chance, continually omitted; nay, one vexed commentator has declared that they must have been left out on purpose to annoy us.

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[1] Quoted by Dr. John Rolleston, "Medical Aspects of the Greek Anthology," *Proc. Roy. Soc. Med.* vol. vii., 1914.

Let us then turn for a moment to these early times, the times of the great Aesculapian temples.[1] The relation of the lay physicians to the temples is one of the darkest passages of medical history. From Hesiod we know that doctors had then formed guilds, such as the Asclepiadae, which were civil and not sacerdotal. Still, as the temples were more and more frequented, physicians no doubt found their way to them; for in all times the sick had sought help of the gods, and mystical schools, such as the Sicilian, the *ἰατρομάντεις* of Aeschylus (three places in the *Supplices*, and also in the *Agamemnon* and *Eumenides*) formed a transition, such as some of the Hippocratic writings indeed suggest, between the pontifical and the more rational medical functions. Or it may be said that, as from the Eastern influences medicine became more superstitious, a fusion came about of the priest and physician who in earlier Greece had been distinct. We have noted already the apparent absence of rivalries between physicians of various kinds and status in Greece, a very remarkable feature. While the power of the god was felt universally, and dreams were for the ancients not fantasies but real events, on the other hand the priests or servants of the temples were, or in Greece became, less of the hierophant than of the clergyman as we know him; the distance between physician and priest was less of an abyss. It seems probable then that some working arrangement between what we may call the Hippocratic doctors and the priests came about; and that with Greek moderation and openness of mind the effects of suggestion were recognised and not disdained. We know that physical means of therapeutics—massage, hydropathy, gymnastics, hygienic rules, and the like, were used in the temples; and not these only but other medicinal means also, such as emetics, purges, local bleedings, unguents, eye-washes, poultices, plasters, and surgical operations. The temples thus became hospitals, but whatever may have been the consideration for the poor, fees were certainly paid: perhaps for the poor out of the revenues of the temples. Such at any rate was the custom in the Egyptian health-temples (Budge, *Syr. Med.* i. Introd.). The idea therefore of a hospital, and more than the idea, whatsoever its applications and conditions, was thus in being many years before our era.

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[1] In *Preuss. Jahrb.* cxxxvi. 3, art. by Schultess on "Ancient Health-resorts in Athens and Epidaurus," has been much quoted. It is but a pleasant tourist's narrative, of no original value.

Harnack (*Med. d. alt. Kirchengesch.*) remarks, on the dissolution of Roman society in the third and fourth centuries A.D., not that hospitals were developing more and more but that the *Iatreia vetera*, dedicated to such patrons as Aesculapius, and Cosmas and Damian, had fallen into ruin. However they were to be repaired, and the dedications converted to Christian saints. It would seem then that the functions of these restored asylums in Christian times were not essentially other than they had been in earlier days.

Originally, when the temples were wholly devoted, as at Lourdes, to religious *numina*, the sites of them were thus determined. But as—at Epidaurus, Cos, and other places—health and charm of position began to assert their efficacy, the site became an essential part of the treatment of disease.[1] These resorts then, whether indeed as health resorts or as religious places of pilgrimage, must have made some provision for temporary residence. The temple of Epidaurus is too well known to need much description here; but the recent successful excavations at Cos by Rudolf, Herzog and others in 1902, may not be so familiar, even to classical scholars. In Meyer-Steineg's book is an illustration of the site of Cos with a conjectural restoration of the Temple, or, as we might call it, Hydropathic Establishment.[2] In the early Empire, on account of some quaking in the earth the site was changed; and we know how lavishly the otherwise disreputable and treacherous physician of Claudius, Stertinius Xenophon, endowed his native place with the wealth, too often shamefully earned, which he left behind him. At this and other periods the precincts of the great temple, and of the sanatorium below it, originally of the third century, were enlarged by many and splendid porticoes, colonnades, terraces, and chambers. The temple seems not to have originated from a shrine, whither physicians may have gradually gathered themselves together, but may have built itself about the ancient medical school of Cos. Its position, from a medical point of view, was perfect: it was sheltered from winds by higher slopes and woods, the water supply was profuse and pure, and the surroundings beautiful. Also, from the discoveries of instruments, we learn that surgery as well as medicine was practised there; for in those times the mischievous division between medicine and surgery, which arose under the later Roman and medieval disdain of handicrafts, had not come about.[1] These temples of medicine remind us somewhat of the infirmary and medical side of the Christian monasteries, not altogether to the advantage of these. It is worth noticing that when, in the time of the Empire, the change of site at Cos took place, the pure and abundant water of the Burinna was changed for another source, the water of which was rich in mineral substances, such as iron, carbonic acid, and sulphur. This change marks the rise of the almost superstitious esteem in which mineral waters were held for many centuries thereafter, and still enjoy.

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[1] Herzog thinks that at Cos the worship of the god Asclepius was founded by immigrants from Thessaly. If so, under Ionian science Thessalian sorcery must soon have been expelled.

[2] In these paragraphs I am indebted to Th. Meyer-Steineg, "Kranken-Anstalten in griech.-röm. Altertum," *Jenaer med.-hist. Beitr.* H. 3, 1912.

I have made some allusion to the *valetudinaria* in Rome; these were unquestionably hospitals, and hospitals so large, well equipped and complete, and manned with a staff so various, as to indicate a long tradition.[2] If it were true that these hospitals were, as supposed in the *Latin Companion*, for the reception only of slaves, they would have nevertheless the character of hospitals for the poor. But, besides probabilities, we have some direct evidence that others than slaves were received into the valetudinaria; and in certain contexts, as of Celsus, Seneca, and Columella who flourished about the date of our era, where these institutions are mentioned no such restriction is suggested. They are spoken of as large hospitals served by several ranks of attendants; ranks entitled *medici*, *optiones*, *capsarii*, librarians, and so on. In his preface Celsus says critically of the physicians of large hospitals that, as they cannot go minutely into every case of so many, they are too content with general notions. Thus, here and elsewhere, *valetudinaria ampla* are referred to casually, as well-known public institutions which had grown to be many in number and of dimensions so large as to be difficult to work. Seneca, who refers to these hospitals more than once, says, in his xxviith Epistle to Lucilius "let us discuss our common woe as if we lay together in the same valetudinarium"; which suggests that rich as well as poor frequented these hospitals. Columella, in his allusions to them, directs that at slack times they should be well aired, and cleansed; so that everything should be well arranged, decorated (*ornata*), and wholesome for the patients. He urges, moreover, that particular attention should be given to the quality of the provisions and cookery. But I need not multiply evidence to prove that large hospitals, partly open to the affluent, no doubt, but also supported by public taxation, existed before Christ, not in Rome only but in the provinces also; and that such institutions probably had existed for some generations before our era. But no such building has been identified at Pompeii or Timgad.

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[1] See the author's *Hist. Relations of Med. and Surgery*, 1905.

[2] Wohnung, *Hist. of Hospitals*, Tübingen, two pts. with plates and woodcuts. Said to be a learned and valuable work on ancient and modern hospitals down to the sixteenth century. Unfortunately, I have been unable either to buy this book or to borrow it.

A reference has been made to Procopius, *De aedif.* ii. 980[1] concerning a hospital for sick poor founded by Justinian in Antioch. I have looked up the passage, but find no more than this mention, "that the sexes were in separate departments and provision made for a cure and attendants." The *hospice for strangers* (ξενών) was another kind of foundation.

So far as I am aware, no remains of such a building—save of course at Epidaurus and Cos—for the use of the general public, have been unearthed. But a strong light upon the plan of lay hospitals is thrown from the side of the military hospital. Even in early ministrelsy we find the fighting doctors (ἥρωες ἰατροί) were not a few, nor merely surgeons (*Il.* xvi. 28 ἰητροὶ πολυφάρμακοι ἀμφιπένονται); Littré (Hipp. i. 6) thinks that the doctors of the Lacedaemonian army were priests of an Aesculapian temple. In the *Anabasis* we note that as, according to custom, groups of wounded and sick were left behind in villages a doctor was left with each; in this case the number of doctors must have been large; indeed some historians compute them at about 1 per 1000. Under the man-to-man fighting of the Republic however there was as little organisation for the care of the wounded as for other military equipment. It seems to have been a point of honour that the wounded should be carried to the rear by the Velites, and after the battle to the camp ; there they were treated in their tents by their comrades. We have seen (p. 204) that some knowledge of medicine was expected of every Roman citizen. That notwithstanding, from the fourth century B.C. physicians systematically accompanied both Greek and Persian armies on the march, and on campaigns, is well known from the testimony of Xenophon and others ; and we know that one Hermias of Cos was employed at Gortyna during the war of 221–219 B.C. (Oehler, *loc. cit.*) ; but whether or no the fighting units of less civilised Republican Rome had this advantage we cannot definitely say. Some of them may have been the slaves or associates of General Officers. One is mentioned in the battle of Lake Trasimenus ; and so again with Cato junior. Vibius Pansa, and others. But Galen and Vegetius in their periods speak of a regular army medical service, and of one Antigonus as such an official. And there are two or three legal or official allusions to *medici militum* or *legionis*. On his Illyrian campaigns Tiberius provided a huge army medical staff ; but Payne suggested this might be exceptional. We find in Celsus good instructions in military surgery. In the military regulations of Trajan four physicians are provided for each cohort, and a similar provision was made for the soldiers of the fleet. Galen mentions also medical officers of the fleet. Later under M. Antoninus in the German wars the medical officers accompanied the army ; in what proportion to each legion we do not know (Payne, *Lat. Comp.*). But these doctors seem to have ranked hardly above the common soldiers, and to have enjoyed but little better pay or social consideration (Haberling, *Alt.röm. Militärärzte*). It is certainly curious that even under the Empire definite reports of military doctors are so few ; they may have been taken for granted. We may presume that a more or less irregular medical service became more regular under the Empire, certainly before Trajan ; though even then the standing of the doctor was but that of an inferior officer. On the return of the army to Rome the wounded were billeted in the houses of private families.

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[1] Bouchier's *Syria as a Roman Province*, Oxon., 1916.

From inscriptions and other sources we know that *veterin-*

arians were employed at legionary quarters, and probably on campaign.

But, as wars were waged farther afield, these primitive methods must soon have been found wanting. The sick and wounded were entrusted to municipal authorities, and in the permanent camps of the standing armies—*e.g.* on the *limes*—hospitals for the sick and wounded, *hospitalia*, as Vitruvius definitely calls them, were built; and we read of *medici castrenses*, etc., as well as of *medici legionis* and *cohortis*. Haberling, in his essay on these military hospitals of the older Imperial Rome,[1] has brought both history and excavation to illustrate this subject. At latest under Augustus and onwards we find that at strong and permanent posts excellent hospitals were provided. Although these hospitals were provided for military purposes yet it is highly probable that they were founded after the plan of the previous *iatreia*, and *valetudinaria*; so that all three may be regarded as mutually interpretative. The oldest of the military hospitals as yet revealed to us by excavation is that of Carnuntum, which was in existence in the first century A.D. Its remains were found at a legionary station about forty kilometres from Vienna, in what is now called Deutsch-Altenburg. The building was specially designed for a hospital, lay near the Quaestorium, and is identified by the discovery of an inscription within its walls. Moreover, its position in relation to other buildings was the same as in the military hospital likewise unearthed at Novaesium, the modern Neuse, near Düsseldorf.

It is evident that one alone of these buildings, however we calculate the space, could not suffice for a force of 40,000 men; there must have been more than one, even if we suppose them to have served only for the severest cases; the less severe being treated, as we are told, in their quarters. From an inscription of A.D. 179 we find that a hospital was built even for one cohort of 1000 men. That under the Pagan Empire the sick and wounded were compassionately nursed and looked after we learn also from a chance tribute to Hadrian "cum aegros milites in hospitiis suis videret"; and to Severus "aegrotantes ipse visitavit per tentoria milites." And, as a tribute to the importance of the hospitals themselves, we find in an inscription that the building of one of them was celebrated by no less a person than a Legate.

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[1] Haberling, "Die Militärlazarette in alten Rom," *Deut. militärarztliche Zeitsch.* J'g. xxxviii. Ht. 11, 5 Juni 1909.

The foundations of a most complete hospital were discovered in the years 1887–1901 in an excavation of the large camp at Novaesium, on the lower Rhine.[1] This fortress, which lay on the Roman road to Cologne, was established by Tiberius; but the quarters were rebuilt in stone by Claudius. The arrangement, as is shown, was on a corridor plan; the entrances and exits were so arranged as to avoid draughts; and the rooms opened into quiet corridors and quadrangles. Novaesium, in the completeness of its departments, may be taken as an example of a chief hospital of the first century A.D.; if in arrangement it reminds us of a Roman private house, yet in its corridor system it presents a very fair resemblance to a modern hospital in so far as accommodation in many private wards is concerned; the large ward system seems not to have been approved by the Roman commanders. It is possible that the separation of patients in small wards in some degree diminished the danger of sepsis; we know that the Roman, and particularly the surgeon in Rome (Galen), was then a very cleanly person; and his water-supply was always provided in great abundance. The small rooms behind the front rooms were probably for attendants, and for utensils. We see there were 38 sick wards; the larger rooms probably accommodated 5 or 6 patients; so that the hospital would hold 200 or more, beside those (isolated ?) in some of the small rooms. It is clear that these large hospitals in a fortified garrison were not mere refuges for the infirm. Many instruments were discovered in the ruin; such as sounds, bronze needles, ointment boxes, and so forth.[2] The patients were dieted well—on plenty of eggs, meat, and oysters; so Professor Haverfield reported to me (private letter) from contents of the rubbish pit.

The hospital at Carnuntum[3] was built on the Danube, 40 km. from Vindobona (Vienna). Of this hospital we have remains of two periods, a simple valetudinarium of the first century A.D. and a later enlargement. In this first period the attendants probably lived outside, so that it was not so self-contained as at Novaesium, or as was the new building which succeeded it on the same site. Carnuntum, as a rebuilding of an older edifice, presents to us a change of plan, an enlargement for a greater need; but also a change of plan according to a development of architectural and sanitary ideas. By the plan it appears that the new design was also on the corridor system, but the central court was made a much larger feature of a quadrangular design. I have said that Novaesium was built on a similar arrangement.

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[1] Bonner, *Jahrbuch* (*Jhrb. d. Vereins v. Altertumsfreunden im Rheinlande*), vol. iii., 1904, pp. 180 ff. and Plate XIII. in separate atlas.

[2] For dentistry see Cic. *De leg.* ii. 24. 60 and passages in Lucian, Martial, etc. Like all else, dentistry fell into neglect until the time of Paré, and its recovery has been very slow until our own generation.

[3] Plans of these hospitals are published in Meyer-Steineg's book; but it has not been found convenient to reproduce them here.

The courses of drainage and ample water-supply, and traces of a heating apparatus are to be recognised on the plan. But to discuss the plan in detail, the places of the kitchen, the apothecary's shop, and so forth, would be to detain you too long. An extant work of the third century A.D., which goes under the name of Hyginus, gives us some, but vague and inaccurate, descriptions of these camps; and he speaks of the valetudinarium as designed to be as quiet as possible for the sick; and of a well-kept garden provided in the inner court for the flower-loving Roman.

A building which, from the large find of medical instruments within it, was probably a ruder form of military hospital, has been discovered with other ruins of a Roman station, in the Swiss Baden at Vindonissa (Windisch), on the tongue of land between the Reuss and the Aar.[1] The late Professor Haverfield told me in 1916 that a legionary fortress had been under excavation there for some years.[2]

Of the medical care of the army under the Byzantine Empire Professor Bury speaks with much approval. No expense was spared, whether to preserve the health of the troops or to cure the wounded. There were nurses for the sick, ambulances, large bathing-houses, and other sanitary provisions. What are we to say of the dark centuries which followed, times of Christian profession in which all this humane and practical provision for the sick was indeed neglected or forgotten!

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[1] Bonner, *Jhrb. d. Vereins v. Altertumsfreunden im Rheinlande*, iii. 1902.

[2] Not students of history only, if these especially, mourn the death of Prof. Haverfield. Personally I have been deeply obliged to him for the pains he so cheerfully took, time after time, even during illness, to correspond on obscure and difficult questions of Roman records and relics with one of the least of his disciples.

With the story of these hospitals, which on the decline of the Empire so vanished that a millennium passed away before, in Spain in the fifteenth century under Queen Isabella, such provision was made for sick soldiers at Malaga and elsewhere, and in the sixteenth century, at the siege of Amiens by Sully, surely, with the story of these Roman hospitals before us, and the default of any such institutions for the most of a millennium of Christian rule in Europe, we should be modest in our presumptions that the hospital is a fruit of the Christian religion. Still if in this interval there are no records of a humane military service, and if moreover we hear too little of civil hospitals, yet some such provision there was; for instance at Salerno. There, before A.D. 1000, was a hospital, under Benedictine rule, staffed with professorial doctors. Among them nearly three centuries later, was the great surgeon Roger, the predecessor and inspirer of Paré. Probably the medical school of Salerno existed even before A.D. 1000, about which date was born that medical renaissance on Hippocratic hygienic lines, which was the glory of that city, and of Europe. It was not however to the glory of Europe that this dawn of a new day of medicine was so soon to be overcast. It was unfortunate that Frederick II. broke the tradition by establishing his university at Naples instead of at Salerno.[1]

These inquiries on public medical services, especially the municipal in which we know that provision was made for treatment by salaried doctors, on the well-known reception of patients by doctors in their *iatreia*, on the subsidising of *iatreia* out of public funds, and on the establishment of civil valetudinaria and the military hospitals, prove beyond doubt that large provision for reception of the sick in special institutions was well known and systematically planned; and that the civic hospital was a familiar institution long before the Christian era. In the earlier time of Epidaurus we know that Health Committees were formed; and, at a still earlier but uncertain date, in Rome, M. Acilius was a *triumvir valetudinis*. Again, later, in the second century A.D. in Greco-Roman lands efforts were made to propagate such medical discoveries as were from time to time achieved, and the means of making them known by conferences or congresses was apparently similar to those employed at the present day. From the *Lancet* of June 23, 1906 I take the following editorial paragraph: "This has recently been illustrated by means of some Greek inscriptions found upon stones built into an ancient church at Ephesus, inscriptions which have been published by Keil in the *Year-book of the Austrian Institute of Archaeology* (viii. 128, 1905). These texts record what may be termed victories in contests, or debates, between physicians; probably a description of public discussion such as took place over a 'thesis' in the medieval universities. It would appear, therefore, that the medical men of Ephesus, and probably of the province of which that famous city was the capital, had a society or association, connected with what in those days took the place of a modern hospital—namely, the town's temple of Asclepios. The contests enumerated at Ephesus in what remains of the medical inscriptions were in surgery, *χειρουργία,* inventions and the perfecting of surgical instruments; *σύνταγμα*, by which is possibly meant a medical essay or collection of essays; and, finally, *πρόβλημα*, which would be the statement and discussion, and, it is to be hoped, solution, of some medical problem specially proposed. There is a special title for some of the physicians enumerated in these inscriptions—that of *ἀρχιατρός*, which may mean medical men possessing public appointments as well as such as stood specially high in the profession. The date of these Ephesus texts is about A.D. 200." In the *Classical Review* 1915, in an article on the pseudo-Galenic treatise Περὶ ζώων, I have discussed the origin of many, at any rate, of the emptier and more rhetorical Greek or Greco-Roman treatises extant, as perhaps the addresses of candidates seeking public medical appointments (see also p. 448). In view of such facts as these how can it be asserted and re-asserted, as in all ordinary treatises on medical history, even in the excellent and welcome history of medicine by the distinguished Washington Librarian, Dr. Fielding Garrison, that the hospital is a product of Christianity, and so practically unknown before the fourth century? It is often said that Basil's Hospital, founded about A.D. 370, was the first.

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[1] See the author's *Historical Relations of Medicine and Surgery*, London, 1905. Also Gaizo, *Janus*, vol. i. 1896–97.

Dr. Garrison does of course allude to the *iatreia* and *asclepieia,* as serviceable to some extent; but the allusion is scarcely adequate, seeing that long before our era, especially in the Greek provinces, we have found mention of hospitals under public control, with doctors officially appointed to them. The truth is these institutions, asclepieia, iatreia, valetudinaria, etc., were closed by decree of Constantine in A.D. 335; some were abolished, others reopened. And if it be also true that in this period, and especially under the influence of the Empress Helena, a great effort was made to establish hospitals anew, we shall remember that if these efforts were inspired by the spirit of Christ yet on the other hand they signified that the closure of the older institutions had made a grievous void, both in charity and in the medical science and art. If on account of their pagan associations a decree was needed for the closure of the pre-existing hospitals, their number and repute, to need so formal an abolition, must have been considerable. To urge, as some have done, that the pagan hospitals were not such because in Rome the spirit of compassion did not yet exist is at any rate an *a priori* and partisan, if not a perverse, argument. On the contrary, we are tempted to suppose that with the extension of the Roman Empire westwards these great military and other hospitals, established presumably in many large centres—such as Bordeaux, York, Lincoln, Cologne—must have carried higher standards of medical practice into Gaul and Britain, a practice perpetuated through Gaul, and even Britain, as a thread of tradition which may have survived the Saxon inroads into later times. Bordeaux never failed to hold a leading place as a centre of culture through the Middle Ages.

The Arab hospitals were large and magnificent, but to point out their debt to Christianity is a fair claim, for these hospitals were built on the Christian models, and after the Christian example.

Among the hospitals of the Christian era, the earliest seem to have been small homes opened by charitable persons; then on a larger scale, like that of St. Basil, founded in the reign of Valens (A.D. 370–380), at Caesarea in Cappadocia; or again that founded by the noble Roman lady Fabiola, the friend of Jerome.[1] Then followed those in Edessa, Constantinople, and, farther west, in Arles, Lyons, and elsewhere. Yet even in this comparatively modern period, as in the earlier, the growth into the Institution that we call a hospital was still incomplete; down to the thirteenth century these edifices were in part almshouses, havens for strangers, for foundlings, and so forth.[1] In the great monasteries the infirmary grew nearer and nearer to the modern, or the ancient, hospital; but in the earlier monastic time at any rate the infirmary was either confined to the inmates of all orders, or, if extended to others, grew out of a house of reception for strangers. We have also to reckon in many houses for leprosy and some other special diseases.

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[1] See Jerome's letter (*Ep.* iii. 10) to Oceanus on Fabiola's death (Appendix, p. 474).

The magnificent new effort for the establishment of our modern hospitals was due to the humane enthusiasm of Innocent III. who, in the thirteenth century, not only founded the great model of the Santo Spirito in Rome but also inspired the founders of many of the great hospitals of Europe; for example in the City of London the so-called five Royal Hospitals of St. Bartholomew, St. Thomas, Christ's, Bridewell, and Bethlem.[2]

Of houses of reception, the *xenodokeion* was of course an ancient institution; primarily it was a lodging-house, but soon almost compulsorily assumed more or less the part of a hospital. These hospices were founded, as we know, chiefly along the main routes of travel, and especially at the points of danger, as at the passes of the great mountains and rivers. If we are amazed to read of the long, painful, perilous and yet continual journeyings of our forefathers, whether to Rome from the West, or faring still farther afield, we shall not wonder that they abhorred mountains and dreaded rivers. Well might the *pontifex*, the builder of bridges, be revered as a half-divine benefactor of mankind. Even to-day on the high passes we still find hospices; as we find them also, or their relics, beside the passages of the rivers, where one by one bridges were built. Thus we recollect that the full name of the great hospital of Lyons was Hôtel Dieu du Pont du Rhône; the Hôtel Dieu of Paris was first founded at the Petit Pont, and thence removed to its present site; and the Santo Spirito at Rome was established by Innocent III. at the old bridge. For, even after the building of bridges, the rivers, of which the passages were guarded, often formed lines of division between one principality and another, and thus still continued to be places of detention.

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[1] *Nosocomeion* is a title of late origin, perhaps little earlier than Suidas. It occurs in verbal form in Diogenes Laertius, and in adjectival in Pollio.

[2] Here I must admire the *History of S. Bartholomew's Hospital*, by Sir Norman Moore, a work monumental in design, in authorship, and in execution.

The first hospital of the New World was that founded in Mexico by Cortez, some peace-offering—let us hope—for his many sins. But we are now embarking upon the main current of modern history, where I no longer pretend to be a pilot.

Appendix to P. 472, note

Jerome's words merit quotation: "Prima Fabiola *νοσοκομεῖον* instituit in quo aegrotantes colligeret de plateis et consumpta languoribus atque inedia miserorum membra foveret."

A CHAIR OF MEDICINE IN THE FIFTEENTH CENTURY[1]

INTRODUCTION

It may be well to remind the reader that Greek medicine, like Greek letters, began to pass into eclipse on the closure of the schools of Alexandria and of Athens; but happily this source of life and culture was not dried up. The wide and permanent influence of Greek civilisation in Asia—partly by Ionian and Macedonian migration, partly by the penetration of Hellenist culture into Oriental countries from Damascus to Samarkand, partly perhaps by the dispersal of many of the Alexandrian books—may be inadequately realised even by the historian. Syria became almost completely Hellenist; and learning, rekindled under the humane and enlightened rule of the great Arab dynasties, was fed by the translation of Greek manuscripts into syriac; these, at Bagdad and elsewhere, were again translated into arabic, suffering no doubt a strange transformation in the double process. The later Arab and Jewish schools at Toledo and Cordova pursued this bastard Greek learning with intense ardour; and in the eleventh and twelfth centuries such scholars as Constantine of Monte Cassino, and Gerard of Cremona were among the chief of those who by another transmutation conveyed it into neo-latin Europe. Thus it was that the thirteenth century gave birth to the "First Renaissance," and became the mother of universities; and that, in however motley a disguise, Greek ideas and traditions regained some ascendancy in the Western World. I will add that the Arabs, in carrying over Greek learning, enlarged it, at any rate in the sphere of natural science, with something of their own.

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[1] This essay (without the Introduction) was read to a small private society in Cambridge (The Eranus), and was not written with a view to publication. On consenting to its publication, it is due to Dr. Maxime Ferrari to confess how much I am indebted to his interesting book. For the more general historical matter outside the life of Ferrari I am alone responsible.

Yet, in the ebb of the Omeyyad civilisation in Spain, these motley and travestied texts, stifled under scholastic glosses, could not bequeath to the Middle Ages any buoyant or abiding life. The Greek spirit soon evaporated; and its vestments, woven by the pedants of the schools and stiff with the embroidery of the scribes, concealed the inward ravages of moth and rust. The evanescent revival of the thirteenth century had no fuel to feed it; and from Albert and Bacon to Erasmus and Linacre, the culture of the fourteenth and fifteenth centuries—in medicine as in other spheres—became an Arabist effigy of science. With surgery—always the saviour of medicine—things were somewhat better, especially in Italy. Men like Lanfranc, Henry of Mondeville—who, with Theodore of Lucca, surgeon and bishop, may be regarded as a pioneer in antiseptic surgery—and Guy of Chauliac, hampered as they were by ignorance of anatomy,[1] and of ligature as a method, and consequently by much diffidence in larger operations which fell therefore to peripatetic lithotomists, herniotomists and bone-setters, and by the disdain of handicraft current in these and later centuries, nevertheless got nearer to Nature than the physician, and adjusted their vision to her perspective. The physician was not brought to book, the surgeon, by many a mishap, at least learnt discretion; an admirable virtue however that is not to be attributed wholly to the modesty of science. In case of untoward events the surgeon "of the long robe" was available for prompt revenge, the adventurer "of the short robe" made off before results declared themselves. In the fifteenth century John XXII. burnt an unsuccessful physician at Florence; and on this Pope's death his friends flayed the surgeon who had failed to keep him alive. Ferrari, in his advice to treat eye disease with "reserve," tells us that a surgical neighbour of his, who (in a case of glaucoma ?) had failed to relieve his patient's agony, and to save her eye, was pursued in the night by her infuriated husband, sword in hand.

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[1] The first attempts in dissection made by Mundini in 1406 were interrupted (at any rate in public, but body-snatching was not unknown in the fifteenth century) by an edict of Boniface IV. At Pavia however the human body was dissected occasionally, on the direction of the Duke of Milan; Leonardo da Vinci, the greatest man the Duchy, and more than the Duchy, has produced, was an accomplished anatomist. Leonardo flourished a little after Ferrari, to whom we may give credit for an effort to make the best of the anatomy possible in his day.

When in the sixteenth century the fountains of Greek had burst forth again, science and letters found their second renewal of life in Italy ; and from Italy the new spirit poured into southern France and into England, while Paris, crushed under wars and ecclesiastical and civil tyranny, lay longer in her medieval prison house. But the reader will understand that in the earlier period with which we are now concerned, medicine was still an Arabist convention, a digest of Rhazes and Avicenna ; and the physician, in no touch with Nature, was wont to lecture from the desk only, and to prescribe for his most distinguished patients even without seeing them. He taught abstractions, and he treated abstractions.

Giamatteo Ferrari da Grado

The Chair of Medicine, the subject of this paper, was in the University of Pavia, and the professor was Giamatteo Ferrari da Grado : or, as latinised, Johannes Matheus de Ferrariis de Gradibus. He occupied his Chair from 1432 to 1472, an unusually long occupation for a Professor in a University of that century. Portal, in his *History of Anatomy and Surgery* (1770), gives the following biography of Ferrari, and all the modern dictionaries have copied his story : " Matheus de Gradibus was born at Grado, a town of the Friuli, near Milan. He came of the illustrious family of the Counts of Ferrara. He enjoyed at first a great reputation in his own province, afterwards he was called to Pavia as Professor of Medicine. The Duchess of Mantua made him her chief physician, which post he enjoyed for some years, and died in 1460." In this biography there are almost as many errors as words. How could a Milanese be born at Grado, in the Friuli ? Is Friuli near Milan ? What connection was there between the name of Ferrari and the Counts of Ferrara ? Ferrari died in 1472. The Duchy of Mantua was not created till a hundred years later.

In 1899 a descendant of Giamatteo, having discovered family papers of considerable importance, and having searched also in the archives of Pavia, published a life of his ancestor,[1] which contains many interesting and intimate features of the history of the fifteenth century, and of university life at that period. The universities of the fifteenth century were, on the whole, very much alike ; and in all of them were created or developed similar orders, customs, and laws, many of which have survived to our own day. Each university however, among other differences, had its bent towards one faculty or another ; thus Paris and Oxford were eminent in theology, Bologna in law, Padua and Montpellier in medicine, and so on. Pavia, like Cambridge in my young days, and unlike Oxford or Paris, was scarcely more than the town of a university.

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[1] *Une Chaire de médecine au XVe siècle et un professeur à l'Université de Pavia de 1432 à 1472*, par Dr. Maxime Ferrari. Paris, Alcan, 1899.

John Matthew Ferrari was born at Milan at the end of the fourteenth century. His father was a member of the College of Physicians at Milan. The name "da Grado" was not derived from his birthplace, but had been a name in his family for more than a century. The elder Ferrari desired for his son the distinction of his own profession, the members of which were truly, if ironically, described by Petrarch as "clothed in purple, with rings on their fingers, and gilded spurs." John Matthew flourished under the following Dukes of Milan : Filippo-Maria Visconti, 1412–47 ; Francesco Sforza, 1447–66 ; and Galeazzo-Maria Sforza, 1466–76 ; he was called to the University of Pavia by Filippo-Maria, to whose Court he was attached : and afterwards in Francesco Sforza he found a steadfast friend for twenty years.

John Matthew must have graduated at Pavia, for under a decree of Filippo-Maria Visconti all subjects of the Duke of Milan were compelled to take their degrees at Pavia, under a fine of 600 florins. ("Non sit . . . aliquis scholaris predictarum civitatum et ducatus volens in aliqua scientia doctrinari vel erudiri qui audeat vel presumat ire ad studium, neque filios mittere, alibi quam ad predictam civitatem Papiae, sub poena rebellionis." Stat. of Univ. of Pavia, July 17, 1412.)

It is an interesting feature in the teaching of medicine at the time that John Matthew was first of all elected Professor of Logic (in 1432) ; and that, although he was made Professor of Practice of Medicine in 1440, he retained the Chair of Logic to the end of his life.[1]

The rivalry of the new universities of the Middle Ages seems to have been as ardent as it is in the North of England to-day. Here, for example, is an advertisement of the University at Toulouse : " This is the promised land where flow milk and honey, where rich pastures are green and trees are laden with fruit (' ubi Bacchus regnat in vineis, ubi Ceres imperat in arvis ') ; the air is finer than in any other province, and at Toulouse wine, bread, meat, and fish are cheap." The University of Pavia was not behindhand in proclaiming its many advantages—cheap lodgings, food almost for nothing, and the best professors in Italy. Bologna, Padua, Montpellier and the rest likewise boasted of the beauty of their country, the salubrity of their climate, the accessibility of the town, and the advantages of their school. The University of Pavia was established by Galeazzo Visconti ; and was instituted by the Emperor Charles IV. on April 13, 1361.[1] A Bill of Boniface IX. on November 16, 1389, only confirmed its privileges. However, during the latter half of the fourteenth century things went badly with Pavia. In 1374, a year of famine, the City Council were unable to bear the expenses of the University, and proposed to suppress it, or diminish it. Happily the Dukes of Milan, Galeazzo II. and Giovanni Galeazzo, protected the University during these trials ; and it was on a fair way of prosperity when in the Plague of 1398 the scholars fled, and the lecture-rooms were deserted. In order to keep some hold upon the scholars the examinations and lectures were transferred to Piacenza ; but it was not until 1412 that Filippo-Maria Visconti re-opened the University of Pavia. Henceforward, not unnaturally, some jealousy persisted between the two cities ; and in 1472 a deputation from Piacenza to the Duke pleaded for the return of the University to their own town. The oration is still extant. Unfortunately for them the Duke refused the request, " et tibiis, ut aiunt, in pera compositis, magno cum dolore et tristitia ad suos redierunt doctores." Under the rule of Filippo-Maria there were no less than 300 professors of the University—192 in law, 72 in medicine and surgery, 50 in literature and philosophy, 24 in theology, 9 in physics and mathematics. It will be remembered however that in the fifteenth century the title " Professor " had not the significance it has to-day ; it meant little more than teacher, and no more than Master, or Doctor, or Regent. In Paris there was no official teaching of medicine until 1505, though certain regents gave voluntary courses in one place or another; as for example around the holy water stoup of Notre Dame. A curious letter, indicative still of university worries, was written by the Rector of the Jurists to the Duke on October 27, 1447, as follows:

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[1] See under Asclepiades, FitzPatrick Lect. p. 180.

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[1] University College, Oxford, was founded in 1249 ; Peterhouse in 1284.

> VERY ILLUSTRIOUS PRINCE AND VERY DEAR MASTER—Of late, in order to pay salaries in arrears, we have had often and importunately to address ourselves to the Jew, who has been very useful to us; but now, forsooth, the Jew will lend no more, and hence the University and its studies are in grievous straits. As this Hebrew is causing great injury to our University, we have decided to appeal to your Excellency to take steps to compel the Hebrew to make us loans as before, etc., etc.

No less a person than Andrew Alciatus declined a Chair at Pavia, alleging that the money went to the soldiery and the fine words to the professors. Thus we find in the archives of the University continued protests in the matter of arrears of salaries, for the professors seem to have been far more scrupulous in the matter of salary than of the punctuality of their courses. Francesco Sforza, more of a soldier than a sage, was too much occupied in defending his Dukedom to be bothered with the defence of letters and sciences. Foreign students were wont to arrive at the universities on St. Luke's Day. In Ferrari's time (1432–72), strangers flocked in large numbers to Pavia, which University indeed, during the fourteenth and fifteenth centuries, became no unequal rival of Padua. At the end of the fourteenth century in Pavia however, as we have seen, their number was few. In 1391 we find three Portuguese, a German and a Pole; in 1395 an Austrian, a German, and a Portuguese bishop, who was made Doctor with great pomp; in 1397 two Frenchmen. But in Ferrari's time we read of large numbers of French and German students, as many as 206 of each. The students divided themselves into "Nations," as was the custom in other universities. About this period also there seem to have been 300 students of medicine, a number which apparently amounted to about one half of the whole number of undergraduates.

The Rectors, who represented the students before the Administration, settled disputes among the students, and compelled them to observe statutes and ordinances, were variously elected in the several universities. In Pavia the Rector was not a Doctor elected by the College of Doctors, but a student elected by universal suffrage. His qualifications were to be unmarried, of twenty-five years of age, of good life and manners, and honourable birth; and it is remarkable that, unless no secular candidate were available, he was not to be a clerk. Not infrequently he was a foreigner; in 1433 the Rector was a German, in 1443 a Burgundian, in 1482 and 1487 a Frenchman, and in 1493 a native of Dauphiné. The Rector was nominated by each Faculty in turn, and for one year: he received from 30 to 50 florins. Twice a week during morning lecture he sat on the bench of the Bedell to assure himself of the regularity of lectures and examinations, and of the observance of the ordinances. The Bedell was selected by the Duke, and discharged the duties of apparitor, secretary, and librarian of the Faculties. Probably the Rector had to swear not to remove the Studium Generale from the city, then no vain formula: at Bologna more than once the students deserted the city in a body: in the fourteenth century the Rectors, Doctors, and Masters of the University of Orleans tried to transfer the University to Nevers; and we have seen something more than an intrigue for the removal of the University from Pavia to Placentia. The stories of the flight of the students of Paris to Oxford and Cambridge, of Oxford students to Cambridge, and of Cambridge students to Stamford, are well known.

The student on his first arrival, on St. Luke's Day, arranged his affairs according to his rank and fortune. Many entered the house of a teacher or professor, whom they accepted as their "father," and paid at a rate settled by ordinance. Exchange of students was not uncommon; for instance, it is noted that a Parisian sent his son to a citizen at Pavia, and received in his turn the son of this citizen in Paris. If some students were wealthy, we all know the stories of the poverty of many of them; how in the Middle Ages they preceded the friar in begging their way from town to town. In a document of Bologna the plight of some of them comes vividly before us. A poor student in the fifteenth century says: "The time I should spend at lectures and in study I am driven to waste in begging from door to door, crying scores and scores of times—'Charity, charity, dear masters,' and getting the answer, 'Begone, and God be with you.'[1] I appeal both to ecclesiastics and laymen, and am mostly driven from the door, or perchance some one may say, 'Wait a bit,' when I may get a dirty scrap of bread which a dog would reject, or I may get fusty beans, bits of skin or gristle, or sour wine. By night I traverse the city, in one hand a stick to defend me against the dogs, in the other a bag to gather remnants of bread, fish or vegetables, and a water gourd. Often I have to return home, filthy with mud, to try to appease my barking stomach with any scraps I might have picked up." To relieve such wretchedness it was that colleges were founded, and many were founded in Pavia. In Paris at the end of the sixteenth century we know that there were more than fifty colleges, sheltering 700 students. Castiglione College, founded at Pavia in 1437, survived till 1803; when it was sold to found four scholarships for members of the Castiglione family. Ferrari himself founded a small College at Pavia. The Colleges were ruled, as we know, on the monastic system. No stranger could be received at table except on the Feast of the Purification. Gradually courses of teaching grew up within the colleges themselves, the process of degrees remaining the privilege of the University. The members of a college were to settle all disputes, and even crimes within their own jurisdiction; that the honour of the college should not suffer. No woman or child was allowed under any conditions to enter, to hold conversation, or indeed to have any relations with, the college: not even to bring victuals, unless it were in charity for the poor. The student in theology might reside seven years, other students five only. It was customary on rising from the table that a student, whosoever in turn it happened to be, should propose some problem in his own subject, and that two others should dispute with him. The formula of Robert of Sorbonne was applicable to all Colleges: "Vivere socialiter et collegialiter et moraliter et scholariter." As in later days, the students formed a class distinct in origin, customs, and privileges from the other inhabitants of the city; and of their independence they took no mean advantage: they seem to have been as disorderly and reckless in Pavia as in other universities of the Middle Ages. The Duke of Milan thus complains to the Rector: "We hear that your students, regardless of order, promenade the streets at night in troops, fully armed as if they were going to war. See that this be amended." Gambling was not put down by ordinance after ordinance, reinforced by heavy fines. In the phrase of Tacitus "vetabitur semper et retinebitur." Another complaint is that the students gave themselves up to all sorts of games while the Professor was in his chair, making an uproar to disturb him and to bring his discourse to an end. At time of carnival there were terrific rows; and, as in other universities, disputes, quarrels, and even bloody fights would arise between the different "nations": as for example between the Germans and Italians. It is fair to quote, on the other side, the following letter of a good boy; "I pass my life in reading, writing, and conversation with sages; I see here virtue in honour, and fine breeding to prevail. Noble persons appear in the streets seeking for new things. I hear the sweet voices of women, as lovely and smiling they pass by in their carriages, ensnaring the hearts of the young men by their sweet looks . . . and so the time passes quickly in songs and laughter and dancing; thus all our cares and pains take flight."

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[1] Cf. Ep. St. James, "Go in peace, be ye clothed and warmed," etc.

In Pavia, as in other Italian Universities of the Middle Ages, —and as fifty years ago in Medicine in Cambridge, which derived many of its customs from Italy—there were three Degrees, the Bachelor, the Licentiate, and the Doctor. I need scarcely say that the Doctor in some Universities was equivalent to the Master in others; thus at Montpellier the Degrees were Bachelor, Licentiate, and Master. The Bachelorship was rather a certificate of study than a degree; there was no examination, but certain certificates were produced, and other conditions required. At Montpellier, however, an Act was required for M.B., and in those days the Act was a very serious business, often lasting from early morning till late night. At Pavia there were no such exercises until the degree of Licentiate, which conferred the *Licentia docendi*; but this degree was not conferred without considerable precautions. The candidate would choose the Doctor who should present him, and, accompanied by his "promoters"—that is to say, two professors under whom he had studied theory in the morning and practice in the evening—he would present himself to the Rector and the Bedell for their testimony to his manners, and for the arrangement of the day and hour of his public exercises. The Chancellor, on the recommendation of four of the Doctors, fixed the day; and he published the titles of the texts upon which the examinations would take place, so that any one could study them beforehand, and enter into argument with the candidate. The Act for M.D. consisted also of a thesis, followed by discussion. What the discussions were—arguments based on corrupt texts, and on glosses of works roughly translated into the colloquial latin of the period, we can hardly imagine : of personal experience nothing, of observation nothing ; for who dare pronounce an opinion against which a master had spoken ? The commentary of the schools was sufficient for all purposes ; the true spirit of criticism had ceased to exist. Dressed up for the occasion, and standing on their tiptoes, these young cocks, as Michelet says, put on heroic airs, and plunged into subtle and elaborate controversies, to the stupefaction of their auditors and of themselves, pouring out their vain and prolix rhetoric until night only could arrest it ; when judges and disputants alike withdrew, puffed up with empty admiration of themselves. I need not remind the reader of the satire of Rabelais on these interminable dissertations.

It is interesting to observe that the degree of Doctor was not necessary for the practice of medicine : it was the completion of the scientific study of medicine : a distinction between academic training and technical instruction too often lost sight of at the present day.

The ceremony of graduation was, at the choice of the candidate, either private or public ; the poor student was glad to avoid the enormous expense of the public ceremony. For example, "Mag. Gabriel de Civitate Belluni, licentiatus in artibus et medicina, petebat de gratia speciali quod possit facere conventum suum private et non publice, eo quia necessitas cogebat et non habebat unde facere magnas expensas." In the amusing notes of travel and sojournings of two students of medicine from Basel in the sixteenth century (Felix and Thomas Platter, MS. Library Univ. Basle, publ. Montpellier, Coulet, 1892), we read of the pomp of these graduation ceremonies, for which the hall of the University was insufficient. The whole Faculty gathers in the Cathedral, whither the candidate fares on horseback preceded by trumpeters. The previous night he had serenaded all the doctors, surgeons, and apothecaries with a band of trumpets, fifes, and stringed instruments. In the hall a collation is served, at the candidate's expense, "de optimis confectionibus et vino malvatico." As the procession passes through the town the merchants shut their shops and the artisans stop their work. Upon the high platform of the Cathedral the Chancellor pronounces a discourse in Latin and hands to the candidate a book, first open then closed, caps him, pronounces certain ritual words, puts a gold ring upon his finger, and finally gives him the kiss of peace. A banquet to the doctors, students, officers, and notables of the city followed this ceremony, when the graduate was wont to return thanks in five or six languages. It is said that in Heidelberg to-day the candidate for the Doctor's Degree provides wine and confectionery on the occasion; and in Paris some such banqueting was customary in the fifteenth century and later. All this was not done for nothing: the examination cost about 600 livres, and the conventus 80; the Chancellor received 25, and he or his vicar about 6 more. Besides these fixed fees, the candidate had to pay the cost of the banquet, and of the dresses for a great many people. In 1311 the Pope ordered that candidates should swear not to spend more than 500 livres over and above the fixed fees of graduation ("ultra tria millia turon. argenteorum." Six "turonenses," as I see in Ducange, made a livre).[1]

As regards the professors, the most striking feature is the great liberty of teacher and scholar; liberty in the plans of teaching, liberty in the selection of masters. At Bologna the professors were chosen by the students themselves, at Pavia by the Duke, according to their reputation and merits; they were engaged for a fixed number of years and a certain number of courses; otherwise they were wholly free. In Medicine the morning lectures were on theory, the afternoon on practice—that is, rules of practice were dictated to the class;—of direct instruction at the bedside there was none but what students obtained occasionally by the favour of practising physicians in the cities. Ferrari, as senior Professor, lectured in the morning. There were lectures ordinary and lectures extraordinary; but as, in the thirteenth century at any rate, universities had no walls nor even any public edifices, it is difficult to say wherein this difference consisted. The teaching of the professors was indispensable; manuscripts were dear, and difficult to borrow. In the fourteenth century Master John of Novaria sold to Master Nicolas, son of the notary Bertuccio da Cicilia, scholar in medicine, the third and fourth books of Avicenna on vellum in one volume, for eight ducats. A copy of the *Continent* of Rhazes was borrowed on deposit of four florins; such loans were always duly witnessed. The invention of printing reduced the cost of books by fully one-half.

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[1] I am told by a Professor of Economics that we have no guide whatever by which to attempt an estimate of the value of these payments by modern standards.

The College of Doctors was not part of the University. There were *doctores legentes* and *doctores non legentes.* At the time of which we are writing there were about forty-two Professors of Medicine in Pavia. The College of Physicians was a close and jealous corporation, and no surgeon, apothecary, or corn-cutter could be admitted to its privileges. The members of this corporation for the most part belonged to the city, but professors of renown, under the attraction of higher salaries, travelled continually from one university to another. Rival Chancellors, like football clubs, would contend for a popular professor, and even seize him and carry him off by force; thus the Florentines imprisoned one Bartholomew Soccini, who tried to leave Pisa for Padua under the temptation of a higher salary. Such a quarrel between Venice and Louis XII. nearly ended in war. In salary the professors of the Faculty of Medicine received 500 to 600 florins, besides the fees for graduation.

The disdain with which the surgeons were treated by the physicians, but more in Paris than in Italy, has wrought much mischief to medicine up to the present day. In Italy surgery was more in honour, and surgeons such as Henry of Mondeville and Guy of Chauliac went to Italy for study. At the beginning of the fifteenth century Pietro di Argelata, who professed surgery at Bologna, and Bertipaglia, who was professor at Padua, were no mere Arabists. In the sixteenth century Benivieni, the Professor of Surgery in Florence, founded pathological anatomy. In the fifteenth and sixteenth centuries there was a Chair of Surgery at Pavia, when at Montpellier and Paris surgeons were thrust out of the gates of these universities; and Ferrari in his published works discussed many surgical operations, as for hernia, hydrocele, varix, etc. Yet even in Italy, before the middle of the fifteenth century, surgery seems to have been largely theoretical; operative surgery can scarcely be said to have begun in Italy till the fifteenth century. The surgeons of Salerno and Bologna however discoursed on the principles of their craft, and showed its dependence upon anatomy and medicine. In the seventeenth century, as I have said, the surgeon came more closely into touch with nature than the physician. The physician at the bedside of the patient would discharge his duty by ostentatiously quoting Hippocrates and Galen in Greek and Latin, while a surgeon, who, by the practice of his art, had been brought into closer acquaintance with the machine he had to mend, would speak more positively and definitely about the patient's state; and this in good and intelligible vernacular. Medicine concerned itself little then with the more concrete phenomena of disease, and was occupied chiefly in harangues on Galenical doctrines of the elements, humours and temperaments, of the dryness or moisture, the cold or the heat of the patient; of his complexion, the qualities of his bile, and the like, arriving at conclusions of elaborate obscurity. The best part of medical practice was the dietetic, due largely to the traditions of Salerno; otherwise it was lucky if no harm was done. Consultations were frequent and numerous, but the surgeon, ignorant of anatomy, scarcely dared to operate, or at any rate left the larger and more perilous operations to peripatetic specialists who had no local connection to lose. The physician's prescriptions ran even into pages, and one wonders how any stomach could tolerate all the drugs prescribed — drugs thickening, thinning, contracting, repercussive, expressive, opilative. resolutive, maturative, mondificative, regenerative, incarnative, cicatrising, etc., etc. The Materia Medica came chiefly from the East. and was brought to Venice, which at that time had the monopoly of the trade between East and West.

As regards preventive or State medicine, the following letter of the Duke to his physician, Ferrari, written in 1451, might serve as a pattern for the Mayor of a watering-place in the twentieth century. To such dignitaries I commend it, especially the words I have italicised:

From the Duke of Milan, Count of Pavia and Angleria,
Lord of Cremona, etc.

Dear Sir—Without laying stress upon the rumours which have reached us concerning the language you have used on the subject of the Plague which is threatening our town, language which was calculated to spread alarm among the people, nevertheless I think it well to write to request you not to occupy yourself with this subject in public; and that you will make every attempt to instil courage rather than fear among the people. You are aware that your words have the authority of your high position; we beg you therefore not to forget that it would be contrary to our peace to spread fear among our subjects. *and to give them a bad opinion of the sanitary state of the town.* We desire you then to moderate your tongue; this, we trust, you will see to, and from this day forth act with prudence.

It is remarkable that Ferrari scarcely mentions astrology, though even Guy of Chauliac, in explanation of the Plague of 1348, admitted the influence of the stars. Nor did he make use of incantations or amulets, though he says that they might influence the disease through the imagination of the patient. He opines that the physician has no concern with ghosts, and that it is his business to refer symptoms to their natural causes. To the stories of wonderful cures he would answer: "But I have not seen them, and I hear tell of many things which I have never seen." It is curious that professional secrecy, as we understand it, did not exist in that day. The patients who were the subjects of the hundred and eight consultations published by Ferrari, many of them exalted persons, are freely mentioned by name, and their diseases audaciously published. This frankness we see commonly in the Consilia of the time. For instance, the fifty-seventh consultation is concerned with no less a matter than Lewis XI. his piles; for which Ferrari, on due request, sends elaborate prescriptions. "Et cuideroit on" (writes Lewis to his Chancellor) "que j'eusse les ammoroites"—is it conceivable that a divine king should be harassed by the haemorrhoids?

Ferrari, who held his chairs till the end of his life, seems to have been a good representative of the physicians of the fifteenth century. He was of his period, but not before it. If his laborious works have little interest for us to-day, they are evidences at any rate of erudition and good sense. And they have one more point of indirect interest. Ferrari left three works behind him—his *Lectures on Avicenna*, first edition, Milan, 1494, which he dedicated to Francesco Sforza; the *Book of 108 Consultations*; and the third and chief work entitled *Practica*. This last work was published in two parts; the second part issued from the printing-press of Pavia in 1471. The date of publication of the first part is unknown, but, as it is spoken of in a letter of the Duke of Milan on November 23, 1469, it must have been among the first works printed in Italy.[1]

In conclusion, we have a complete catalogue of Giamatteo's library ; a fine one for its time. Many such catalogues are extant, and are useful as giving a good notion of contemporary learning. That of Ferrari consisted of 89 MSS. : among them the *Articella*, a well-known medieval medical handbook, containing portions of Hippocrates and Galen ; of Serapion ; of Aristotle's *Logic*, *Rhetoric*, and *Physics* ; the *De animalibus* of Albert of Cologne ; treatises by such Arabian physicians as Rhazes, Avicenna, Mesue, Averroes, Albucases, Maimonides, Haly-Abbas, and Izaak ; and the works of many physicians about his own time, such as John of Gaddesden's *Rosa Anglica*, Bernard of Gordon's *Novum lilium medicinae*, James of Forli's *Exposition of the First Canon of Avicenna*, Nicholas of Florence's *Lectures on Medicine* (wholly Arabist), Gentile of Foligno's *Avicenna*, and parts and fragments of other such lore. It is notable that all, or virtually all, the books in Ferrari's library were printed in the last quarter of the fifteenth century, or very soon afterwards.

Dr. Maxime Ferrari has given us a very interesting book, and I trust he may forgive me for adding to this review of it some little gossip of my own.

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[1] The first book known to have been printed in Rome is dated 1465 ; the first in Milan, and in Venice, in 1469 ; in Paris in 1470 ; in Bologna, Florence, Naples, Pavia, etc., in 1471 ; in Lyons in 1477 ; and so on : thus the first part of Ferrari's *Practice* must have preceded most of these. It went through nine editions.

THE RISE OF THE EXPERIMENTAL METHOD IN OXFORD[1]

In this age of steam cars, of steam ships, and of steam balloons, the mobility of the European people in the Middle Ages is still marvellous to us. We try to picture to ourselves knights, troubadours, pilgrims, merchants, friars, scholars driven by demons of unrest about an unparcelled world; and of this medley scholars were perhaps the most vagabond. "O curiosi ingegni, Peregrinate al mondo, cercate tutti i numerosi regni." As Petrarch said of them, "Agitatione mentis et corporis ignorantiam discussuri," they swept in flocks, like birds in their migrations, from school to school; having no country but in the several quarters, or "nations," where they were gathered together; for the European nations in our sense did not exist. During the five centuries after the Conquest the realms of Italy, Burgundy, France, England, and the Empire were variables as inconstant as their peoples; what we now call a university was then no particular spot on the earth but, like the Ark in the wilderness, moved whithersoever a great teacher, such as Fulbert, Lanfranc, the Anselms, Abélard, or Peter Lombard, unfurled his standard. This mobility was indeed the guarantee of the freedom and the power of learning. Not till the fourteenth century did the "ius ubique docendi" fall to dependence on charter from pope, king, or bishop; till then the scholar owed no vassalage. Chartres was no more a French school, in the modern sense, than Oxford an English one; Alcuin, Sershall, John of Salisbury, or Alexander Hales were Englishmen chiefly in the accident of birth. Gradually however, by tillage, by the invention of printing, by the difference of tongues, and by the hammering out of national boundaries, folk became attached to the soil, and the means of culture had to be brought within the reach of those who dwelt at home.

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[1] Being the Ninth Robert Boyle Lecture, delivered before the Oxford University Junior Scientific Club on May 13, 1902. (Reprinted from its *Journal*, May 1902.)

But this change came about very slowly; while at no time was adventure more ardent than in the sixteenth century, yet the printing press of Gering and Rembolt was in safe keeping within the precincts of the Sorbonne whose censure, in spite of the favour to letters of Louis XI. and Francis I., was tenaciously and inquisitorially exercised in regard of the sale as well as of the publication of books. In England, under the harsh rule of the Star-chamber, very few presses were licensed; to Oxford and Cambridge were allowed but one press each, and between the Archbishops and the Stationers' Company even these two had a bad time. Indeed in the sixteenth century, unless at Wittenberg or Basel, freedom of speech was more closely stifled than in the time of Abélard. In the sixteenth century Ramus, ejected from Paris, was repulsed even at Genoa; in Italy the naturalists of Cosenza and Naples could not prevail against the conventional Aristotle; and Bruno, who fought Aristotle lyrically and allegorically rather than scientifically, was burned for his pains. One may go to the stake for error as well as for truth; but, as Voltaire said, "Il faut avouer qu'on brûle quelquefois les gens un peu légèrement." It was not until the day of Descartes and Gassendi that the 'Αριστοτελουμαχία was virtually decided; and that the Accademia del Cimento, the Lincei, the Royal Society, and the Academy of Sciences in Paris took possession of the debated territory, and converted the hierarchical ferocity of the sixteenth century into the culture and humanity of the seventeenth.

"Till a man is sure that he is infallible it is not fit for him to be unalterable," said Boyle; and well may we wonder to see the weight of the yoke, not of the Aristotle of Melanchthon, but of the scholastic Aristotle, imposed for three centuries on the faithful as the final form of infinite truth. Herein even Calvin was docile, and favoured the inculcation of academic peripateticism. I say we may wonder; for we have but to carry our memories back to Philip Augustus to see, in 1209, that the "Civitas Philosophorum," as St. Thomas called Paris, was engaged in burning all works imputed to the Stagyrite. The *Metaphysics* of Aristotle appeared in Paris about the beginning of the thirteenth century (Launoy, *De var. Arist. fortun.*); in

August 1215, the teaching of the *Metaphysics*, and of the *Physics* also, was forbidden in Paris under pain of excommunication.[1] This, and other outrages, chiefly by the masterful hand of Blanche of Castile, on the " Lehrfreiheit " of Paris—then the university not of a fragment of modern France, but of Western Europe—at the time when the culture of the first renaissance was streaming into Europe from the Arabian sources, drove its scholars abroad ; and, begging their way from gate to gate, long flights of them came to the comparatively unknown schools of Oxford and Cambridge. These Universities arose not in coastward ports and towns, such as London, Colchester, Lynn, or even Lincoln, great school as it was in the thirteenth century ; nor again in upland cities such as Winchester ; but under the shadow of fortresses commanding the head waters of eastward rivers where, while access to the outer world was easy, traffic penetrated far inland. Oxford was a great political city, often a royal residence ; its trade was extensive and, as things went, peaceful : Cambridge commanded the gates of Mercia, and its fair (Stourbridge), confirmed by charter of King John, was the greatest fair in England, perhaps the greatest in Western Europe. Moreover as the Oxford school wisely kept clear of bishop and monk, so those who settled in Cambridge squatted just without the grip of Ely. Oxford, the courtly city, a centre of public affairs, became the picturesque stronghold of hierarchical traditions ; while Cambridge, happy in having no early history, was let alone to develop " its Whiggism, and its mathematical school." When, in the interests of Rome, James II. brutally harried Oxford, Cambridge was, comparatively speaking, unhurt ; yet Oxford—engrained in its submission to authority in Church and State—was nevertheless still hotly Jacobite in the rising of 'Forty-five.

For like reasons Oxford sprang more suddenly than Cambridge into fame ; scarcely had European scholars begun to gather there at the opening of the thirteenth century when it grew rapidly into one of the largest schools in the world ; chiefly, as it would appear, on the scholastic side, under the influence of the Friars Minors. The Franciscans settled in Oxford in 1224, the Dominicans had preceded them in 1221. In these Orders the professions of poverty and simplicity did not then extend to penury of the mind. Happily the great teachers Hales and Albert, each of whom in his own Order opened out a career for profane learning, were for their age rare scholars. Hales was a lesser light than Albert, yet Hales, under the encouragement of the learned and enlightened Gregory X., was reading and expounding the Arabian Aristotle: beyond the mutilated Organon known to the twelfth century, he had other treatises before him, physical and metaphysical; and the former were a potent aid in the revival of natural science. But Oxford held one greater both of heart and mind than either of these—Robert of Lincoln; who, and whose pupils Adam Marsh and Roger Bacon, became Greek scholars of no inconsiderable attainment at a time when Greek had virtually died out of the West. To a Studium Generale of the Middle Ages the potable gold of Greek tradition came slowly and hardly; trickling down in scanty and turbid rills, or choked at its sources. For a hundred years at least after the rage and wreck of the Dark Ages—of the sixth and [1] seventh centuries—had crushed it out of England and hither Europe, slender stores of Greek survived in the schools of Salerno (as the vehicle of Methodist Medicine), at Aurillac,[2] and in Ireland.[3] Alcuin of York died in 804, and in the ninth century neither in Oxford nor in Cambridge, so far as we know, were there schools to attract the teaching of Erigena; we do not find indeed at the court of Charles the Bald, where he was withstood by Hincmar the Hildebrand of Rheims, that any Greek or philosophical teaching of his took root. Erigena was but a meteor in the history of medieval culture, yet some sparks of his fire kindled the Moslem schools of Spain, whence Avicebron handed on the "Scottish" torch to Duns. The study of Canon and even of Civil Law seems to have survived that of the arts and sciences; and in the tenth century the law school of Pavia had some reputation. In a few schools of Italy and Germany also, in the time of Otho the Great, the lamp of learning still burnt fitfully.

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[1] In the library at Douai (Cousin, *J. des Savants*, August 1848) is a MS. of Roger Bacon on Aristotle's *Physics* and *Metaphysics* in heavily corrected writing of the fourteenth century, and entitled " Rogerius Bacon, ordinis Minorum, de rebus physicis, monasterii Sancti Petri Corbigensis," a curious sidelight on Bacon's troubles in Paris.

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[1] Even in Italy, owing partly to the distracted state of the Peninsula and in part to its Latin civilisation, Greek was disappearing as early as the sixth century; and translations of Galen, Soranus, Rufus, Oribasius, etc., into more or less barbarous Latin were prescribed by Cassiodorus for his convent: these and such counterfeits held the field for some centuries, even in Salerno; and indeed did carry forward some civilising tradition.

[2] William of Auvergne was born at Aurillac, and there is some little evidence that he used books in Greek.

[3] Irish monks wandered about Europe, not a few of them; but whatever their personal influence may have been, they founded no schools. Bobbio could hardly be called a school?

In the thirteenth century, when Oxford began, we have evidence that Greek was taught, and for a short time even flourished; but of its quantity or quality we have little evidence: in England, as elsewhere in Western Europe until the fifteenth, or rather early sixteenth, century, in spite of a renewed effort to establish it in the first quarter of the fourteenth century, Greek, as I have said, seems soon to have died out again, and with it the inspiration of natural knowledge.

In the eyes of monk and mass priest the friar, and above all the academic friar, was abominable; thus, fortunately, the makers of the University clustered about the parvises of St. Mary's—the Mont St. Géneviève of Oxford—rather than within the cloisters of St. Frideswide or Oseney; the need of education for the secular clergy being perhaps a principal factor in the growth of these schools: such indeed was Merton's avowed purpose. Chroniclers rather than philosophers, no monk, not even a Benedictine, entered the arena of scholastic disputation.

We need not take up the old question why Roger Bacon became a Minor.[1] This question can only be solved by remembering that all teaching, and indeed all intellectual life, was then in the hands of the clergy; and that even the freemasonry of the informal tonsure conferred substantial immunities upon the errant scholar. Let us endeavour also to picture the enthusiasm of the time when the radiance of the evangelist who founded the Order, who had breathed a larger and humaner spirit into the world as St. Augustine and St. Bernard had done, was still in its afterglow; of the time before the tide of the Faith against audacious and impious philosophers had turned in Paris and Oxford, as in the eleventh and twelfth centuries it had done in Baghdad; of the generation before the Victorians and Bonaventura became the Sufis of Europe. Whether in Orient or Occident, mysticism and scepticism are—to use the language of the physicist—the ions of the disintegration of creeds.

The Preaching Friars were always on the side of authority, indeed in 1243 the Dominicans came to the decision to abstain from the study of physical and medical science; the Minors on the other hand were then a vigorous and healthy force in support of the people against the usurpations of the nobles, of the Crown, and of Rome herself. Adam Marsh, himself a Minor, was a statesman, a close friend of Simon of Montfort, and moreover a champion of that freedom of learning which abates ecclesiastical and feudal pretensions. Balliol, where we are now gathered together, was founded under Franciscan influence. And was it not due to this first temper of the new university, and perhaps of Balliol, that in the next century, and then in the teeth of the Greyfriars, Oxford was keenly Lollard? It is certain that with the suppression of Lollardism all intellectual life deserted her courts; and, producing nothing but tracts on alchemy and magic, she shrank to one-fifth of her former company.

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[1] I see in the *Collectanea Fr. Min.* it is said simply that he did so under the persuasion of Grosseteste.

Alexander of Hales, the leader of thought in Paris, was General of the Minors. Robert of Lincoln, who made Oxford—as Abélard made Paris, and Fulbert made Chartres—and who was the father Sarpi of the University in the early thirteenth century, was himself Rector of the Order, and bequeathed his library to it; and had Adam Marsh, on the death of Hales, accepted the office of General of the Order, the cause of learning and science might have withstood its adversaries; and the sowing of Bacon's genius might have had another harvest. Herein the desire of Grosseteste to keep Adam Marsh for Oxford was successful at the cost of Western civilisation.

We are too apt to look back upon the thirteenth century with the eyes of Langland and Chaucer; or, through the lurid light of the sixteenth, with the eyes of Montaigne. In the thirteenth century men wrote respectfully of the friars; Roger Bacon, like Grosseteste, was not only a faithful son of the Church, but he was fired also by the conviction that in the study of nature he was treading one of the paths of divine revelation. This was the conviction which dictated the passionate pages of the epistles to Clement. The Franciscan was soon to travel as far from St. Francis as the Christian from Christ; but for the moment the barbarity which had wrecked the world, and the asceticism which had spurned the filth of the flesh, were melting away in the sunshine of Saint Francis' sweet converse with all created things. As yet the Sorbonne was not, or was only in its kittenhood: the ironic prudence of Padua was not yet formulated. Albert at Cologne, vindicating against Paris the science of the

Arab schools, dignified the study of natural knowledge and experiment; and this is his true title to fame. Glorious churches, new and splendid arts were springing up on all sides. Famous schools received new foundations, and privileges from popes and kings; Canon and Civil Law were opening out new careers; and the Church, scarcely awake to its danger, forgetful of Erigena, Roscelin, Abélard, Amaury, and David of Dinan, was for the moment proud of its vocation to rule in the realm of faith with a docile philosophy, and science the servant of philosophy. Both in England and abroad the Friars Minors were for a moment the chief ministers of the new learning, as the monks had been of the old; and for a few short years they deserved this honour. It was in this season that Oxford, the offspring of Paris, under the inspiration of the great Franciscans who made its school, drew the breath of life, and prepared the way for Walter of Merton—the friend of Marsh, for William of Durham, John Balliol, and Hugh of Ely, who laid the stable foundations of the two great and ancient Universities of England, Universities which, during the adversity of Paris in the fourteenth century, were greatly strengthened and enlarged.

The encroachment of Civil upon Canon Law, which made some way at Bologna, had offended the Papacy, which was therefore disposed to favour Paris, and to inflate its theological and dialectical schools. In Oxford, it is true, the Faculty of Civil Law grew stronger than in Paris, and derived some strength directly from Bologna; moreover in England the Common Law was stealing away the prerogatives of both; yet in order to understand early Oxford aright we must still remember that Oxford was a child rather of Paris than of Italy, and, like Paris, resisted the Italian culture.

The pioneers of science may be divided into two kinds: into a group of men who, like Galileo, Boyle, and Harvey, were themselves discoverers, and a second group, like Roger Bacon, Telesio, Campanella, Francis Bacon, Ramus, or Marsilio, who did service rather as protestants and reformers of method. Whether Roger Bacon were more of a chemist than Albert of Cologne, or whether either of them got beyond the chemistry of Geber; whether in optics, his special study, Bacon went beyond Al Hazen, it is perhaps less important now to ascertain than to declare Bacon's glory to be that with a new and a passionate insight and mighty pen he proclaimed the true method of investigation.

But we must no longer say that Roger Bacon sprang up as a voice in the night, alone. That his voice rang with a clearness, depth, and certainty beyond the voices of all other prophets of his age is sure; to suppose that he cried as a solitary out of the darkness would be against the probabilities of history. Hales, it is true, was little more than an eminent schoolman, in outlook even behind Albert: but Grosseteste had larger visions than either; he was no inconsiderable geometer; he wrote a treatise *De iride et de cometis*, and was a keen inquirer into new sources of knowledge, including the "Res Physica" or Medicine. Our records of the researches of the time are scanty; the rivalries of priority, indeed the duties of acknowledgement, were practically unknown in Bacon's day, and for long afterwards; but Bacon was acquainted with the remarkable dynamical work of Nemorarius, and he generously proclaims his debt to Peter of Méricourt [1]—a Picard—of whose observations in magnetism we hear from no less a man than Gilbert; [2] this Peter moreover, so Bacon tells us, was a contemner of dialectical tangles and a master of experiment. Thomas Bungay, the eighth Provincial Minister of the Friars Minors, is well known by name as an associate of Bacon; he was probably engaged with Bacon in natural investigation, and, like other such inquirers, including Albert and even Sylvester the Second, was regarded as a wizard. Mr. Little tells us that Bungay lectured in Cambridge also, "being the fifteenth in the list of Franciscan Masters there." [3] To Bungay Mons. Charles attributes a manuscript in the Bodleian (E Musaeo 155, pp. 414-26) beginning "Amicorum intime, quamdam magnetis lapidis," etc. Mr. Little thinks that even Peckham came more or less under the influence of Bacon.

The rich outpouring of Arab scientific tradition, quickly as it was mopped up again by the Church, inspired many of the more original minds of the age with a love of natural knowledge, and in Italy thenceforth natural science recovered some abundance of life; but in Paris on the Isis, as in Paris on the Seine, scholasticism surged up again, and these rudiments of natural knowledge were buried under the Aristotelian-Galenical cenotaph by that busy gravedigger Duns the Northumbrian; they were not dug up again till the day of Abbot Maurolycus and Vesalius, nearly three centuries later. Grosseteste and Adam Marsh had gone to their rest; Roger Bacon was prisoner of war; and not only was natural science extinguished, but a little later Greek letters also disappeared, until the time of Grocyn, Linacre, and Colet—in Dean Rashdall's words, "the most fascinating decade (1490–1500) of Oxford annals." The world, it seems, was too young yet to quench its passion to begin at the core of things; its passion to carry the inner fortress of truth by assault with the proud engines of the Faith:

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[1] See Appendix A.

[2] Mere allusions to the magnet as a compass are not uncommon even in the thirteenth century; as by Alexander Neckham, and Brunetto Latini, and earlier writers. The magnet was floated on a straw in water. There are about a score of MSS., in Oxford and elsewhere, of Peter's famous letter on the Magnet.

[3] *Grey Friars in Oxford*, 1892, p. 153.

> Hoping to still these obstinate questionings
> Of thee and thine, by forcing some lone ghost,
> Thy messenger, to render up the tale
> Of what we are.

Was a fervour such as this to be spent upon secular collections of curious information; to be attenuated into multifarious plodding sagacities?

So it came about that one of the most genial societies, and one of the most piercing intellects our land has produced founded no school; though Dr. J. H. Bridges illustrated the persistence of energy by the interesting observation that Bacon's work on the error of the Julian Calendar influenced Paul of Middelburg, which Paul it was who urged Copernicus to make more accurate astronomical tables. Bacon noted also the error in the precession of the equinoxes, and compared the rainbow with the spectrum observed when on a summer's day the sun's light enters a chamber by a small opening. It is not easy, however, to claim for him much more than was known to the Arabian schools, which he followed also in his belief in judicial astrology, a belief which William of Auvergne perhaps stood alone in denouncing. That Bacon's "Perspectiva," even if known to Descartes, had much influence upon his optical researches is, I think, a hazardous proposition. Had Descartes been in possession of the *Opus Maius* he might have got some good out of it. Indeed, the evidence seems to me to be against Dr. Bridges' attribution to

Bacon of the discovery of the parabolic concave mirror, and its focus.

If I may rely upon the series of able essays on the history of science published a few years ago by Wiedermann,[1] and especially upon the essay of 1890 on the history of the burning-glass, which he founds in part on two unpublished papers in the India Office, this mirror (obtained by conic section) and its focal properties had been described by Al Hazen. More, I think, was known to the Arabs and taught by them than is generally admitted. We know that Alfred Sershall was lecturing on Arab physics when Bacon was born; and it is to a remarkable man, Nemorarius of Borgentreich, who died in 1236, and of whose researches Bacon was aware, that we owe the first departure from the statical conceptions of Greek and Arabian mathematics, and the initiation of dynamics. Dr. Bridges attributed to Bacon the very interesting axiom that not sound only, as Aristotle knew, but all radiations of force also, in any of its modes, must take time, however incalculable the durations; this, in respect of light, Aristotle had denied. Indeed no Greek had conceived of measurable forces as causes of changes of motion; it was left for Galileo to begin the proof that they are calculable quantities. Bacon stated also that substances opaque to light are penetrable by other radiations, as by those of heat or sound. But, it cannot be admitted that Bacon, or any immediate follower of Bacon, "set the problem" of the telescope; if by this we are to understand the discovery of its principles without their technical realisation. He and others before him had no doubt attached a convex to a concave lens, and ascertained that near objects become larger and nearer thereby; this, and moreover that spherical and even chromatic aberration are thus diminished, was known in early times; but the telescope seems to have been wholly unknown even to that consummate mechanic Tycho Brahe in the latter part of the sixteenth century.

By the name of Tycho we may be reminded that in the History of the Natural Sciences too little emphasis has been laid upon the construction of apparatus. Guilds of such artificers existed in England in and after the thirteenth century, and in Italy still earlier; but with one accord the great experimenters, even those of the sixteenth and seventeenth centuries, complained of the difficulty of obtaining craftsmen skilled enough to carry out the designs submitted to them. Boyle complained that he could not even procure tubes accurately bent to a definite plan. Notwithstanding, more or less effectual instruments were made somehow; and multiplied discovery prodigiously. The names of many ingenious constructors occur to us at once: of Archimedes, of Hero, of Leonardo, of Tycho Brahe, of Gilbert, of Galileo, of Huyghens, of Hooke, of Papin; as in our own times of Faraday, or of Ludwig: how various and elaborate indeed such apparatus had become even in the seventeenth century we may see in the Demonstration Books of Gravesande—the Dutch disciple of Newton, and of van Musschenbroek. In this field of research Oxford is not inglorious; here Roger Bacon, whose expenditure of money and labour upon machines seems to have been enormous, was a forerunner of Boyle and Hooke. Nor are we to suppose that Roger's machines were clumsy and rudimentary; the Alexandrian and Byzantine Greeks, and after them the Arabs, had constructed apparatus of surprising elaboration and ingenuity; and we may be sure that Bacon's machines were well abreast of their time: unhappily, like the author of their being, they fell into decay and oblivion. The Dover Castle clock, with a horizontal pendulum or governor, not taken down till 1872, when it was removed to S. Kensington, was first set up in 1348, and is still in going order.

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[1] Wiedermann's *Ann.*, 1873, 1883, 1884, 1890.

We are apt to suppose that experiment is a new thing; it is no new thing: Aristotle made experiments, even Pliny made experiments; Bacon and Bungay made experiments, Albert of Cologne and Nicholas of Cusa made experiments; from those days to these experiments have never ceased; yet modern science is built not on experiments but on *the experimental method.* I have said already that herein, and not in any discovery which has come down to us from him, nor only in his refusal to grind up the ancients in a logical mill, lies the glorious memory of Roger Bacon. Before Galileo, he it was who first proclaimed, and proclaimed earnestly, that by the ordering of experiment after a definite plan discovery is to be guided, doctrine tested, error dissipated, and the succession of natural phenomena ascertained. And in this way of research the name of Galen ought not to be forgotten. Roger Bacon proclaimed, what even Aristotle scarcely comprehended, that casual experiments are but curious incidents; and that knowledge consists not in accumulation of curious incidents, nor indeed in divination of remote or primary causes wherein effects are to be found, nor again in searching behind phenomena for their essences or formative substances, but in detecting and concatenating by the experimental method the series in which they occur. A remarkable example of this insight we find in Bacon's conception not only of the scientific value of wide and accurate scholarship, which is attested by the silent witness of his works on Greek Grammar, one of which now lies in the library of Corpus Christi College, but also of the comparative study of languages; this latter conception was not attained even by the great humanists of the times of Erasmus and Casaubon: indeed we are disposed to regard it as peculiarly our own. Finally, Bacon discriminated between experiment and observation, even more clearly than certain newspaper correspondents of the twentieth century. If particular discoveries attributed to Bacon may be none of his, to declare that his work was but criticism, if great criticism, is then a grave historical error. His conceptions were as constructive of true method as they were destructive of false; and in the long run to construct a true method is a greater service to mankind than to discover items of knowledge.

Times of decadence have their heroes, as times of growth; and on Bacon's eclipse the able and conspicuous man of the decadence of Oxford was Duns Scotus, probably a Northumbrian: by Duns the waste products of thought were spun into a shoddy which for three centuries made the shroud of Oxford science. So late as the sixteenth century Tyndal speaks of "the barkynge curres Dunce's disciples, and lyke draffe called Scotistes, the children of darkness who raged in every pulpit against Greke, Latin, and Hebrue." In the fourteenth century, such learning as the regular clergy had harboured in the neo-latin period, since the day of Cassiodorus, was dissolving in worldliness; the poverty of the friar was becoming a sturdy and impudent trade, and the blight of the Black Death fell upon the folk; yet as in the long wars Paris waned, Oxford and Cambridge grew; and in Oxford—the Wittenberg of the fourteenth century—arose Wycliffe, kindled and edified by that father of the Reformers, Ockham—Ockham the Luther of the Middle Ages, as Bacon was the Galileo, and Chaucer the Montaigne. Like Montaigne and

Rabelais, Chaucer brought the vernacular tongue into the world of letters. In Wycliffe the Oxford man of science has his part: before Luther he asked Luther's question "Warum?"; and on Wycliffe also it was retorted that *cur*, *quare*, and *quomodo* were the words of infidels, and of the Devil himself who started "un pourquoi" in the Garden of Eden. Nay, to us Wycliffe comes even nearer than Luther, who was apt to look upon all science and philosophy as *γνῶσις ψευδώνυμος*. In the fourteenth century the strong discipline which had consolidated Europe was yielding in every direction; government was no longer a monopoly; at the Senior University of Europe—at Bologna—the Civil Law, as I have said, was permeating the Canon Law; the third estate was growing up; and, in 1378, even the very chair of Peter warped and split. Italy, then the intellectual head of Europe, was ablaze with the New Learning, and teeming with men who were mirrors and torches of culture; "although," as Thomas Wright of Oxford put it a little later, "with brazen faces they be deprehended in enormious crimes."[1] The great maritime adventurers also were not only enlarging geography and widening men's conception of the earth, but they were forwarding also the study of astronomy, of the magnet, and, thus onward, of instruments of precision in other kinds.

Even in the evil sixteenth century the school of Cosenza, though soon stifled by the Jesuits, denounced the scholastic Aristotle; Regent Murray and George Buchanan established Ramism at St. Andrews, and Ascham brought it to Cambridge, while Melanchthon and his followers were restoring the true Aristotle. And even in Parisian Oxford, which repudiated More and Greek letters, the yoke of theology, which has dominated the natural sciences almost to our own day with a thraldom which Cambridge, always more Italian and less aristocratical, partially escaped; even in Oxford this yoke had been lightened by the gospel of Wycliffe. About 1480 Cornelius Vitelli had taught Greek in the University. William Selling also, and Linacre, the master of Erasmus, returning from the footstool of Politian, brought to England the waters of this well of all the sciences.[2] Andrew Boorde, who visited and revisited the universities of the Continent, was perhaps the first writer on Sanitation after the passing of Salerno; and perhaps the first after Hippocrates to discuss the aspect and health of the dwelling-house. Great was the wealth which the fifteenth century had poured into the lap of the sixteenth; but at this time the functions of Oxford as a seat of government were not altogether to its advantage as a seat of learning. Parliaments had been held in Oxford occasionally, from the thirteenth century, so that the hierarchical reaction of the sixteenth was severely felt in city and university. The example of enlightened tolerance which Leo X. had set to Francis I. and to Henry was soon to be quenched. Erasmus, more fortunate than Dolet, died just in time to save his skin: after Henry and Wolsey came Mary and Pole; after Leo and Bembo, Paul IV., Pius V.—the preacher of persecution, Catherine of Medici, the black-hearted Guises, and the eve of Bartholomew; Oxford and Cambridge however suffered far less than Paris from civil and religious tyranny, and were not grievously despoiled.

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[1] *Passions of the Mind*, London, 1604.

[2] Lily, the first High Master of St. Paul's, appointed by Colet in 1510, was unable to find a teacher of Greek in Venice.

A great historian has said that liberty never yet entered a country without bringing knowledge and taste, art, and science in its train. Even of civil societies this doctrine would need qualification, especially as regards despotism and "taste"; the converse however is true: and Paris learnt the bitter lesson that when liberty was put to flight the spirit of truth flew out with it.

Elizabeth, ploughing painfully with the Romanist ox and the Anglican ass, yet never forgot the countenance which her great house had given to learning; she was attracted by Italian culture, and showed some favour to the Universities; she went indeed so far as to order two bodies of her criminals to be delivered yearly to Cambridge for dissection; a boon we would willingly recover to-day. The countenance of Charles I. to science it were ungrateful to forget; and even the renegade James II. was more a termagant in Oxford than a wolf.

Near the end of the sixteenth century, when the fashion of Italian learning, language, and manners upon England still prevailed, and when all religious fugitives were welcome, we get a curious glimpse of the Oxford of the day in the life of Bruno. Bruno visited England in June 1583, with the French Ambassador, Castelnau, the translator of Ramus, and a man of learning, who protected Bruno as de Noailles protected Campanella. Bruno entered Oxford at the time of the enthusiastic reception of the notorious Lasco, a Polish noble, bishop of fabulous wealth, and convert to Protestantism, who soon afterwards absconded, over head and ears in debt, ungratefully carrying off with him two alchemists, Dee and Kelly; who by the way may have failed to prove themselves valuable booty. Bruno narrates that Leicester, then Chancellor of Oxford, with Dr. Humphred, Tobias Mathew, Arthur Gellard, Martin Colepepper, and Herbert Westphaling,[1] met Lasco, and conducted him in triumph to Carfax. Pageants, plays, banquets, and oratorical exercises, at All Souls, Christ Church, Magdalen, and Woodstock, lasted for three days: while Lasco "deliciis literariis satiari non poterat."[2] Bruno gives an amusing account of the disputations:[3] the titles of two of them being *Is it possible to predict by means of the stars?* and *Are men longer lived than women?* Poor science, no doubt; and Bruno was to try to teach Oxford better. The Earth, said Aristotle, Paris, and Oxford, is motionless; the Universe is finite, and moves. Bruno, in the name of Philolaus and Copernicus, protested that the Earth revolves: and that the Universe is infinite. The dispute grew venomous. Bruno declares that he stopped the mouths of the Doctors fifteen times; but we have heard of these fifteen refutations in other stories. "Vide, tace," says one of them pompously, "et disce; ego te docebo Ptolemaeum et Copernicum"—as we say to-day, "I'm not arguing with you, I'm just telling you"; but no sooner did he describe the heavens than Bruno quickly proved to him he had no acquaintance with the treatise of Copernicus. Another, says Bruno, drew himself up, placed his hands on the table, cast a glance around, lifted his eyes serenely to heaven, smiled subtly, turned his tongue in his mouth, spat on the floor, and began: "Intelligis, Domine, quae diximus?" In the *Satyre Ménippée* it was not the orator but the audience which "sonorement et théologicalement tousse, crache et recrache, pour ouyr plus attentivement"—a reflection worthy of Voltaire. Another Doctor shouted at Bruno, "Quid! nonne Anticyras navigas? tu, ille philosophorum protoplastes, qui nec Ptolemaeo nec tot tantorumque philosophorum et astronomorum maiestati quippiam concedas"; and so forth.

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[1] The name of Herbert Westphaling raised some pleasant memory which for a while I failed to recall, till it came back to me in Walton's *Life of Hooker*. Westphaling was Vice-Chancellor when Hooker incepted in Arts in 1576.

[2] The blustering comedy of the great preparations for the christening of Jacob Barnet, the fury of the Heads on his elopement, the capture of this learned Jew on the London road, his incarceration and pains in Bocardo, Casaubon's mediation and the release and expulsion of Jacob, as told by Pattison in the *Life of Casaubon*, will come into the mind of the reader. But in speaking of Casaubon's visit as a singular glimpse into Oxford before Wood's time, the Rector may not have remembered Bruno's visit some thirty years previously.

[3] Note on school disputations in medieval history.

Bruno, after these functions, in a letter written in the *humeur fanfaronne* characteristic of the time, and of these tribunes of free thought, asked permission to teach in Oxford; and it was granted him. We may regard his claim to be "dormitantium animorum excubitor"—so Ulrich von Hutten called himself the "Auferwecker"—as a reproach to Oxford, or a compliment to himself; but I fear Bruno's sallies were as ill received in Oxford, which was still a "fief of Aristotle," as in Paris: he seems to have been even less successful in combating the physics of Aristotle than was Ramus in respect of his dialectics, or Luther of his ethics. Oxford said of him, "He has actually written against Aristotle; and he is suspected of worse things still." At this time in Oxford, as in Paris, Aristotle ruled by statute; and deviation from the *Organon* involved a fine. Bruno's lectures were on Cosmography, on Physics, on Psychology, and even on that grievous matter of the individual, or universal, soul, on which, so long as the Church could not get at them, the Paduan Averroists disgorged their rhetoric.[1] The English scholars seemed, I fear, rather blockish; or was it that Bruno was something of a bore? However, if he found the men clownish, ignorant, and deaf to the voice of science, happily the daughters of the Thames made amends for them.

> Belle e graziose ninfe, virtuose e leggiadre dame.

Women are good listeners, especially to rhetoricians; but the lucky Bruno was adoring Rosalind, Imogen, and Perdita; nay, Portia again was not made in Italy.

If Oxford reflected the manners of Paris, if its professors were courtiers, as on Anglican principles the bishops were princes, at Cambridge also, I regret to find though the history of the sister Universities is by no means always parallel—that Sir John Price, Visitor of the Monasteries, at the time of the great Visitation in 1535, "observed in the Heads great pertinacity to their old blindness": but, he added, "that if they were gradually removed, learning would flourish here; as the younger sort be of much towardness." Even to-day I find that it is given to elders of dignified colleges to understand that the future is with our scholars, not with ourselves.

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[1] How in the sixteenth century matters of knowledge were not tested but discussed, is well shown in Thomas Wright's *Clymactericall Yeares*, published in 1604. Wright, having taken an ague at Como, holds a "Symposium," in which the nature of an ague is discussed by two physicians, a doctor of divinity, and himself. Having threshed the matter out thus, they accepted that opinion which they "liked best" as the true one.

Before we approach the brilliant band of Oxford men of science in the seventeenth century, we may return for a moment to the name of Robert Recorde, fellow of All Souls, and doctor of medicine of Cambridge in 1534. Recorde is an interesting example of the integrity of science and medicine; for in Oxford, among other things, he taught mathematics, rhetoric, cosmography, astrology, anatomy, and even music. He was a zealous antiquary also. Recorde is said to have introduced algebra into England; and his *Whetstone of Witte*, a book of advanced arithmetic, is said (*Dict. Nat. Biog.*) to be "an oasis in an age deficient in science." He practised medicine under Edward VI. and, although a protestant and a reformer, in Mary's reign also. He is interesting to us now as one of the first advocates of the Copernican theory, which was propounded as an unproved hypothesis in 1543. We cannot wonder if in such dangerous times Recorde was something of a trimmer; as would appear from his writings, he made some terms with geocentric dignitaries; with an "Astronomia caudataria."

In the year 1610, when Henry the Fourth had fallen under the dagger of Ravaillac, the parliament of France seized the occasion to ordain a suppression of the doctrines of Ramus; and, to reinforce the scholastic foundations of religious teaching, laid down elaborate schedules for the courses of philosophy in Paris.[1] But for Richelieu's favour, Gassendi's first volume of the *Exercitationes paradoxicae*, published in 1624, would have cost him dear; and he did not dare to continue the work. The Faculty of Theology expelled the opponents of medieval Aristotelian pedagogy from France, and burnt their theses. Even Descartes, who had dedicated his *Meditations* to the Sorbonne, and fawned upon the reactionary party to the point of declining to receive

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[1] In Oxford fifty years later the chief condition for the degree of M.D. was three years' attendance upon lectures in Arabic.

Galileo, whom Milton visited in prison ; even he, one is almost thankful to say, found it convenient to reside in Holland, where, in his own words, he expired " in the realm of the bears, between the rocks and the glaciers."

History discovers to us that orthodoxy is a social rather than a religious need ; and that if these needs come into conflict it is not society which goes to the wall. Happily then in the seventeenth century, " certain extravagant chemists," some of whom Oxford holds in proud memory, Ramists, Paracelsians, and Italianate philosophers, if many of them were short of religion, were shrewdly assisted by a new social factor ; by the worlds of letters and of polite society. As Petrarch and Boccaccio scoffed at the academic coxcombs of Padua, so in France, two hundred years later, the sceptical *bonhomie* of Montaigne, the revolutionary philosophy of Charron, the merciless raillery of the *Mariage forcé*, and the polished satire of Boileau, did more to pierce the armour of the Church than the hardier rebels had done to bruise it. By them the shabby Aristotelian effigy, long battered by the weapons of Roger Bacon, Galileo, Harvey, Telesio, Descartes, and Locke, and bedaubed with the missiles of Patrizzi, of Ramus, of Verulam, was at last broken up and demolished.

Absit omen ; but the growth of the natural sciences has never been a continuously ascending curve : like that of the fine arts, and in synchronism with it, it has flowed and ebbed, with long sandy wastes on the ebb. The century which begat Albert and Roger Bacon begat also Giotto, Siena, and the Gothic architecture ; 1564 saw the death of Vesalius, but, blessed among years, brought forth Shakespeare and Galileo, while Tintoret was painting in the Scuola di San Rocco, and Michael Angelo in the Sistine ; fourteen years later Harvey was born ; in Boyle's childhood Inigo Jones was finishing the Banqueting Hall ; and the time of the foundation of the Royal Society saw also the foundation of landscape painting by Hobbema and Ruysdael. Thus again, the first half of the nineteenth century which knew Wordsworth and Turner, Dalton and Darwin, saw modern music soar into life as quickly and triumphantly as did the great churches of Amiens and Lincoln in the fourteenth. On the coming of age of science in the seventeenth century the nurture of Oxford and Cambridge had borne a large part. An organ and a witness of this adolescence was the establishment of those learned societies [1] which, in their commencement, were rather experimental laboratories; such were the Cimento, the Lincei, the Academy of Sciences of Paris, and the Royal Society: and in the creation of this last Oxford took a well-known and important part. Furthermore, it was fitting that this part should have been played in the courts of Wadham, which, like Emmanuel, had lately been founded in the cause of liberty of thought, and in our own day again has been the seat of a new schism. The story has been told so often that I must not tell it again at length. Warden Wilkins seems to have been a man of many gifts; as a politician his influence with both factions was considerable; he was, as Wood puts it, "a learned man and a lover of such"; moreover he was comely of person and courtly of breeding. Evelyn, in his *Diary*, has left us an attractive picture of this "most obliging and universally curious scholar," his "dear and excellent friend"—"who showed him many scientific toys." [2]

At Wadham Wilkins gathered about him, in 1649, such men as Seth Ward, the Savilian Professor of Astronomy; the incomparable Wren; Boyle; Wallis, the Savilian Professor of Mathematics; Dr. Thomas Willis, an eminent physician who introduced iatro-chemistry into England; [3] Richard Lower, the furtherer of Harvey's work; Goddard, Warden of Merton and Fellow of the College of Physicians; Dean Bathurst; Sir William Petty, and others, who not only busied themselves in experiment, but also knew that only by methodical experiment is natural science to be built up.[4] Unfortunately no laboratory notes of that time are preserved, if indeed they were made; and of many series of interesting experiments we hear but by chance allusions.

The Royal Society did not draw its origin from Wadham primarily; the scientific club had been wont to meet at the Gresham College from 1645: but the unsettled state of the realm made them desire less distracting quarters, where indeed the club was unpopular enough, but where skits and counter-skits were the most poignant weapons of war. Nevertheless, of

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[1] Della Porta's *Accademia Secretorum Naturae* was the first of these; but, unlucky in its name, it fell under the suspicion of Paul III., who suppressed it.

[2] On Evelyn's second visit he found Boyle, Willis, and Wren occupied with a telescope.

[3] See FitzPatrick Lectures, p. 260.

[4] Hooke seems to have been brought into the circle by Boyle a few years later.

Wilkins it may be said, if of any one, that he was the founder of the Royal Society; he was chairman of the promoters during the initial stage, and he was the first secretary. Thus, Mr. Wells[1] is justified in making, on behalf of Wadham, the claim that his College was the cradle of that great society, for which the Royal Charter was obtained in 1662.

In recording the appointment of Wilkins to be Master of Trinity in 1659, I am reminded of the continual give and take between the Universities in those days. In reading the lives of the worthies of the time it is surprising how frequently translations occur; not only that teachers passed readily from one University to the other, as did Seth Ward or Wilkins, and as Recorde had done; but other graduates also, considerable and inconsiderable. We find graduates in Arts of the one taking the degree of M.D. in the other: a graduate of Laws in the one passing to a higher degree in the other; a Fellow of All Souls is M.A. of Cambridge, and so on: surely a most wholesome mutual indebtedness. Thus it is that, to their common misfortune, by railways places are divided.

Many years ago, from the sixpenny tray of a bookstall, I bought three sheepskin quartos of the works of Boyle; and made never a happier purchase. My admiration for a great man and, may I venture to add, my attachment to a new friend, began as I looked between the leaves on my way from the bookseller to my lodging. In the history of ideas they are interesting books, in the revelation of a delightful character they are fascinating. What a perfect instrument was his mind; what a gentleman he was, by nature and by breeding! In his essays Boyle reveals himself almost as Elia did; one learns to know him as one knows Montaigne. If at times he be a little garrulous, he is the more homely, the more intimate; but how quick, and how fresh is the irony of his "Examen" of the rough onslaught of Thomas Hobbes upon "the Society, which is wont to meet at Gresham College," and upon Wallis, Ward, and himself; how polished and elegant his weapon when compared with the coarse violence of contemporary scholars and publicists. In one of those imaginary Dialogues, in which a man of straw is put up but to be beaten off by the prowess of the author, Hobbes had said, "You confess then that your Collegiates have as yet in nothing advanced the knowledge of natural causes, but that one of them has found out an engine in which there may be such a motion of the air excited that the parts of the sphere may together every way tend to the centre, and that the Hypotheses Hobbianae, before probable enough, may be thence made more probable." To this Boyle quietly answers, "If by this engine his hypotheses are made more probable, some will perchance think that to be enough to entitle my experiments to some degree of usefulness, unless Mr. Hobbes's doctrine of the air had found more embracers than, before these seasonable though despised experiments, it was observed to have." How dignified the "Examen" in its courtesy, how accomplished and how effective, may be read further in this tract, printed at Oxford in 1662.

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[1] *History of Wadham College.*

When, on his declining metaphysical conceptions, Hobbes taunts Boyle with making "unobvious" (*i.e.* whimsical) experiments, Boyle upbraids Hobbes for endeavouring to disparage experiments, and to discourage others from making them; "which if he could by his Dialogue effect, I dare be bold to say he would far more prejudice Philosophy by this one Tract than he can promote it by all his other writings. Wherefore though his disparaging of Experiments would probably have much more Authority if he had been the Author of considerable ones, yet, lest for all this his Fame and Confident way of writing might prejudice Experimental Philosophy in the minds of those who are yet strangers to it, I thought it not amiss" [to publish this vindication]. "'Tis easy for a great Wit frequently enough to mistake, and much more frequently to miss of clearly demonstrating what he pretends in matters Physical, for want of having sufficiently considered the experiments he would be thought to despise; and Mr. Hobbes' Adversaries need not be much ashamed of the name he has given them of 'Experimentarian Philosophers.'"

In the matter of his own investigations into the elasticity of the air—or the "spring" of the air as he terms it—wherein Hobbes censures him that he "has not gone into the cause of Springs in general," that omission seeming to him very unworthy of a philosopher, Boyle points out that the Gresham College Society has forborne, for weighty reasons, "to determine the causes of things, or to deduce them from Catholic principles of philosophy, but to devise and repeat experiments which may put opinions to trial and judgement."

It would appear that Boyle began his work in science at an early age; he says he "first began to consider what Fluidity might be when quite a boy." It is not only remarkable that he should have devoted himself to pursuits then far from common among the men of his time and circumstances, but also that he should have been endowed by nature with a temper so sensitive to truth, and with a sagacity and an industry in research, such as are not familiar even among men trained in the methods and equipped with the knowledge of our own generation. Both in practice and in his understanding Boyle seems to have grasped more clearly than did Francis Bacon—whose works, he tells us, he had hardly looked into lest they should prepossess him—the conception that science is advanced not by experiments but by the experimental method; and, far more clearly than Bacon, the place of hypothesis in research. In respect no doubt of the Summists of the Medieval Schools, of whom Robert Pullen, of Oxford, was the first and Francis Bacon not altogether beyond the limits of the last, Boyle says well, "It has long seemed to me none of the least impediments of the real advancement of true natural philosophy that men have been so forward to write Systems of it, and have thought themselves obliged either to be altogether silent or not to write less than an entire body of Physiology." This practice "leads the student to suppose that the whole subject is already sufficiently explicated, and it were needless for them to put themselves to trouble and charges in making further inquiries, but thankfully to acquiesce. Subtle and inquisitive men who spend time in accurate Prosecution of research, and are thoroughly acquainted with the difficulty of clinical investigations, are least of all forward to write Systems."

Boyle seems accordingly to have set the example of the scientific essay, of the "paper" as we call it nowadays, whereby an author may convey to his public any new facts he may have discovered, and new opinions which he has formed, without supposing it needful for this partial advantage to write a capacious and systematic work in which indeed his own ha'porth of bread may chance to be lost. Furthermore, he tells us how to write our papers. In writing them he says "the experiments should be described with the conclusions, or we may be in danger of erring with the writer; but if he describe his experiments, be his opinions never so false, we are at liberty to benefit by the former. And scientific writing should be rather clear and significant than curiously adorned"; on the other hand, while objecting to "too spruce a style," he adds, "I approve not that dull and insipid way of writing which is practised by many chemists."

Nor are we to confine ourselves to positive results, negative results are valuable; nay, we shall record our failures, for in nice experiments we have to learn how various and subtle are the conditions on which results depend. He urges also that for the inquirer no facts are too humble.

"I shall not scruple," he writes, "to confess to you that I disdain not to take Notice even of Ludicrous Experiments, and think that the 'Plays of Boys' may sometimes deserve to be the Study of Philosophers . . . for Nature acts very seriously, and is in very good earnest, whether we Men be so or no. . . . Learn hence this Lesson, That there are many Things in Nature that we disdainfully overlook as obvious or despicable, each of which would exercise our Understandings, if not pose them too, if we would but attentively enough consider it, and not superficially contemplate, but attempt satisfactorily to explicate the nature of it."

The playful banter with which Boyle disposes of cosmic philosophers, such as "that most ingenious gentleman Monsieur Descartes." is more effective than heavier artillery—"Those Heroic Wits to whom the Commonwealth of Learning is exceedingly beholden for plausible speculations in the most primitive and Catholick Affections of Matter." He goes on to say that he is apt to impute "many of the deficiencies to be met with in the theories and reasoning of such great wits as Aristotle or Campanella to this very thing, that they have too hastily and without a competent number of experiments presumed to establish principles and to deliver axioms." And of this he gives a pretty illustration; that at Leyden he was admitted to a camera obscura which gave a lively representation of certain objects while they were looked on with a weak and indeterminate degree of light; so diverse philosophical theories may appear well-proportioned fabrics, yet if the fuller light of new experiments and observations be fréely let in upon them "the Beauty of those delightful but Phantastical structures does immediately vanish. . . . To destroy them 'twere needless to bring battery engines, since nothing is requisite to this effect but a little increase of light."

He perceives that the way to get reputation " is to venture to explicate things and to promote opinions," and is well aware that " among the more daring and less considerate sort of men he will pass for a drudge of greater industry than reason, who may collect experiments for others." But he himself had often found that after " framing notions and hypotheses " they were " soon after disgraced by some farther or new experiment."

On the other hand, he is quite clear as to the value of hypotheses, although he " cannot but represent that a hypothesis depends not upon first principles," but upon whether it stand the test of experiment or not. In contemplative moments he was wont to make lists of experiments whereby to test his ideas. He knows that " a suspension of the exercise of reason is impossible," and that it is conducive to the discovery of truth to permit the understanding to make hypotheses, " and by its own errors to be instructed ; yet such superstructures should be regarded as temporary, and to be tested with a proportionate number of experiments." Whewell announces to us, in that judicial tone which oftentimes conceals injustice, that Boyle, although a meritorious and curious fact-digger, lacked the insight into methods and relations which is characteristic of genius. The Master of Trinity was rarely so much mistaken. Besides the laws on the volume and elasticity of gases, the chief of which work was done fifteen years before Mariotte, besides his researches on respiration, which led directly to Mayow and Cavendish, besides his more accurate quantitative estimations which prepared the way for Black, the careful reader of his works will, I think, admit that by his insight into chemical affinity, by the breadth, orderliness, and exactness of his methods, and by his scorn of the theosophic mysticisms of Böhme and Fludd, he made chemistry for the first time an academic study.

His mind was very active concerning Solidity—" Firmness," as he calls it—and Fluidity, and was unconvinced by the ascription of solidity by chemists to the principle of " form," to a cementing spirit, or to a saline principle of coagulation ; all of which explications do but throw the difficulty one step backward: or indeed offer an explanation harder than the problem itself; whereas, he often tells us, "to explain a thing is to deduce it from something or other in Nature more known than itself." For his own part he observes that the brief duration of the melted state does not remove such "liquors" from the category of fluids for the time being. He feels sure that firmness and fluidity are concerned with some mutual attraction and dispersion of the minute particles of which bodies consist; and surmises that under certain conditions of intimate approximation they may hook on to each other. On this problem, as well as on those of the pressure of the air, he brought to bear the experiments on the adhesion of polished surfaces on which he was very often engaged. Why some fluids damp what they touch, and other fluids, such as quicksilver, do not, puzzles him for a time; but he discovers humidity to be a matter of congruence of the particles of the liquor with those of the body it touches. We are wont to attribute to Francis Bacon the conception that heat consists in a vehement motion of the invisible particles of bodies, to Boyle this conception was a familiar one (p. 117). For instance he said in 1659, "Heat consists chiefly if not solely in vehement and tumultuous agitation of the small parts of Bodies," on another page it is a "nimble motion of their minute particles" (*New Exp. Phys.-Mech.*, 2nd ed., p. 204, and *Phys. Essays*, p. 137).

Of the value of authority he says, "What this or that man thought I dispute not . . . there are degrees of reliance on others, however great their names." In quoting Aristotle, Theophrastus, or even Pliny, for whom he had too much respect, he remembers how hard he himself had found it to make and relate an observation faithfully; thus, when he had looked into divers matters of facts delivered in their writings "with a bold and impartial Curiosity," he was shy of building upon foundations he esteemed so insecure; much less would he rely upon the "suspected Passages that Wecker, Paracelsus, Porta, etc., abound with." Time after time he says, as Harvey said, and as Galen said, "*Do not suppose but try.*"

A very curious confession follows this paragraph, which perhaps may be attributed to Rosicrucian influences; namely, that he "deliberately conceals some parts of his labours"; he has some "experiments concealed"; he is "always provided with some Rarity to barter with those Secretists that will not part with one Secret but in exchange for another; and think nothing worth their desiring that is known already to above one or two Persons."

We must not suppose that Boyle made but showy, occasional, or argumentative experiments; his experimental researches were evidently very extensive and systematic; he is always ready to cite long series of them. Moreover in two essays on "The Unsuccessfulness of Experiments" he betrays an astonishing personal experience of fallacies, and of their many causes; such as impurities, whether adulterations of materials of research —saying with van Helmont, "quod venale extat, fraude plenum est"—or due to the variableness of natural bodies, such as ores, or herbs grown in diverse soils or seasons; or again the variable texture of specimens, such as of blocks of ice used in optical research; or latent errors in processes, even by persons "assiduously conversant with the materials they employ"; or the variability of conditions, such as external temperatures and the like, sources of embarrassment which he illustrates by the perplexity of Aselli who failed on occasion to demonstrate the lacteals, but whose sagacity led him to detect the cause of failure in the time coefficient of feeding the animals. He lays down rules of mean error of measurements, whether in the observer or in his apparatus, and appeals to "indulgence for manifestly careful and modest observers"; nevertheless he would lay some claim to have used "exacter scales and a somewhat more wary method than others seem to have done," and to have prosecuted his inquiries in such several ways as should by their small differences assure him he was not much mistaken.

The range of his curiosity was boundless. A chance acquaintance told him how rarely he drank, sometimes not for days; Boyle promptly noted his complexion, and measured the amount and kinds of his diet, and the quantity of his urine. He tried to discover how substances, ordinarily insoluble, such as bones, could be "dissociated" in a dog's stomach. In his travels he discusses technical processes with miners, with metal-founders, with chemical manufacturers, with stone-carvers; and draws the attention of such persons to interesting details previously unnoted by them.

Boyle began the study of nature as a chemist, and throughout his career chemistry was his chief occupation; but, soon perceiving the interdependence of the several spheres of natural knowledge, he says that his chemical researches led him to the physical "because air is a necessary condition of living creatures, and also is concerned in many phenomena in which its part may be unsuspected." He notices the spiracular respiration of insects, such as bees; and discovers that "the presence of the Air is more necessary to these animals than the presence of their own Heads" (*New Expts.*, p. 198). From a passing remark in the essays on the fallacies of observation, we learn how assiduously he had attended upon dissections of the human body, and this by the way at a time when the nerves of the Regius Professor of Medicine of Oxford—Sir James Clayton, M.P. for the University—were too refined to allow him to assist at such nauseous exhibitions. As instances in this subject of such fallacies he mentions some of the now well-known variations of anatomical structure in man, with which he associates adhesion of the pleura, the degrees of which "in his own experience," he says, are very variable. Against "the common opinion" that it is "the motion of the thorax which fills (the lungs) with air" he alleges, "As our learned friend Dr. Highmore hath well (and congruously to what ourselves have purposely tryed) observed, if a live Dog have a great wound made in his Chest, the Lobes of the Lungs on that side of the Mediastinum will subside and lie still . . . the diligent Bartholinus affirms the like of the Diaphragme also . . . indeed the Diaphragme seems the principal instrument of ordinary and gentle respiration, altho' to restrain respiration the intercostall Muscles, and perhaps some others, may be allowed eminently to concur." In another place he shows how anatomical preparations can be preserved in certain liquors, and he took deep interest in Lower's remarkable experiments on the transfusion of blood, experiments suggested by Wren.

That "positive levity, as some Peripateticks speak" is an imaginary quality, Boyle had proved by observing the movement of vapours upwards as the upper strata of the air grew thinner (*i.e.*, as he explains elsewhere, as they have a lower column of superincumbent air on the given area) and are moved by currents. Also by the use of certain "smoaks" in a still air, or in his receiver, he showed that such vapours found their levels just as do fountains or rills of water ; furthermore, that even interfering flames may " preserve their own surfaces."

" Suction " he had proved to be " pulsion not attraction " ; and, in opposition to any supposed " aversion of Nature to a Vacuum," he demonstrated that air may be weighed in pounds and ounces, and its rise in exhausted tubes measured by inches. Add but an inch he says " and you will surmount (Nature's) much magnified detestation of Vacuities." Thus he arrives at the truth that the outer air rushes into the lungs because the pressure of the air within them is much weakened by the expansion of the chest ; " the lungs being dilated by being filled."

It is remarkable how patiently he considers what now appear to us to be whimsical opinions and conjectures ; disproving them by experiment after experiment, and acute argument. Some specious conjectures he had himself almost accepted, till he tried, observed acutely, and saw their falsity. Let us take for example the prevalent belief that the use of respiration was to cool the blood (p. 257) an " opinion which not only seems to be received amongst Scholastic Writers," but also " divers of the new Philosophers, Cartesians and others, admit it with some variation." This opinion he considers sagaciously ; he does not see how it can apply to those animals which, respiring by lungs, live in cold water ; or to cold-blooded animals which respire by lungs ; or again to decrepit old men whose natural heat is very languid ; or to persons languishing in disease but who often have the necessity of frequent respiration. Moreover a temperate air is often better than a cold air. He suggests that it is against the economy of nature to make the blood of so excessive a heat that it needs to be perpetually cooled. Again, to his touch the heat of the heart of an animal does not feel burning, but gentle. He tests the ambient air about an animal dying in a sealed vessel, and finds it is not sensibly hotter than the common air. In his own dissections he could never see how the cooling current was conveyed into the left ventricle of the heart ; furthermore he noted that the systole and diastole of the lungs are not " synchronical " with those of the heart.

Boyle then turns to the hypothesis of the purification of the blood in the lungs from " excrementitious steams." The heart must need an " ambient yielding body into which recrements of the blood may be expelled," and in which ambient medium they may be conveyed out of the body by way of the "aspera arteria." Yet he thinks when the air is attenuated in the receiver of his pump the vapours should escape but the more readily, and the animal find a benefit in it. He rightly surmises that if a man should be carried aloft into the higher strata of the atmosphere he would die, as the mice do in his receiver; here unfortunately he is bewildered by the contradictory reports of travellers, but he quotes Josephus Acosta who was distressed on the higher mountains of Peru, and relieved again on his return to lower air. For he had proved that the atmosphere is not light but heavy, and its particles "only not dissipated into space because their gravity hinders them." His observations on gills lead him to perceive that they are analogous to lungs, and that air is necessary to fishes (pp. 111 and 248); and he proposes to experiment on the duration of life in fishes in closed tanks of water, reminding us he had proved that "particles of interspersed air are apt to lurk in water, whereof it seems not impossible that Fishes may make some use, either by separating it, when they strain the water thorow their Gills, or by some other way." Unfortunately the only living fish he could obtain at this time for his receiver was an eel, whose tenacity of life left him in a divided mind between the need of air to fishes and the unusually vivacious nature of eels. How gills should be a means of aerial respiration was no difficulty to Boyle, who, as I have said, by many experiments—such as the slight compressibility of tap-water, and its behaviour under the air-pump — had satisfied himself that under ordinary circumstances water contains air. By this mixture he suggested an explanation of the axiom, which he attributes to "our English Democritus, Dr. Harvey," that the blood of the fetus is renewed in utero: "in the womb," he says, "the fluids of the mother may hold air," for "even in the closest and most ponderous liquors there lurk undiscernable parcels of air which bubble out at low pressures."

Notwithstanding he still thinks it probable that there is something more in respiration than ventilation and depuration of blood. "Methinks," he says, "it may be suspected that the air doth something more than barely help to carry off what is thrown out of the blood in its passage through the lungs. Surely a brief delay of these matters would not kill so quickly, for in disease they must be longer detained. . . . We may suppose there is in the air a little vital quintessence (if I may so call it) which serves to the refreshment and restauration of our vital spirits" (p. 262). Barely to assert this, however, he adds, is idle until it be "explicated and proved."

In this context he refers with interest to the story of Drebbel's ship—a ship which, whether phantom or not, was a subject of much curiosity to the savants of the time—for it was alleged that in it men had voyaged under the surface of the Thames; an achievement for which, however, there seems to be no sure evidence. The story is discussed in the letters from Huyghens to Papin, edited by Gerland at Berlin in 1881, and by others; if I remember right by Pepys. Boyle suggests that Drebbel may have provided himself and his fellows in the ship with some "spirituous part derived from the carcase of the air," a conception which brings us very near Mayow. He concludes the discussion by saying, with St. Austin, "Mallem quidem eorum quae a me quaesivisti habere scientiam quam ignorantiam; sed quia id nondum potui, magis eligo cautam ignorantiam confiteri quam falsam scientiam profiteri."

It is needless for me to enter into the course of Boyle's researches upon the elasticity of the air, and on the phenomena of the air-pump, for by these researches his name is immortalised. His means of measurement of air pressure by columns of mercury and of water are also the well-known parents of later manometers. In these researches he was embarrassed by the daily variations of the mercurial column—that is, at a given level, for of course he knew all about Pascal's observations on the Puy de Dôme: he attributed them "to some accidental mutations of the air"; he proved them not to be due to the temperature of the room, to changes of position, nor even to the tides of the sea, a notion which Wren, on the basis of Descartes' calculations, had suggested to him. Moreover in his researches on respiration and on germination he was baffled by the difficulty of maintaining a constant vacuum.

Boyle denied that he was either a Vacuist or a Plenist, or an adherent of any such metaphysical doctrine favoured by Mr. Hobbes and others. While he proves that sound becomes fainter and fainter as the air is pumped out of the receiver he yet asserts that the vessel cannot be void, as objects if not audible are visible: this, he says, must signify either the emanation or the brisk motions of some subtle matter; for without some substance as its vehicle, he argues, "it is not to be seriously imagined that light could be conveyed." By further experiments he proved that "the magnetical steams of the earth always pervade" the exhausted receiver. We are apt to undervalue such masterly reasoning because of the oddity, to us, of the technical terms used; but we shall remember that scientific nomenclature was then in an early stage of making, and that many words to which we are now accustomed are no better, some of them indeed worse, than those in use two hundred and fifty years ago.

Boyle, like many "naturalists" of the day, was much let by the want of artificers able and ingenious enough to construct machines; but to this subject I have referred already.

By dwelling upon Boyle I have left myself but little time to speak of his great Oxford contemporaries; of Wren, Hooke, Lower, Mayow, or Locke.[1] In Wren the architect we are apt to forget Wren the savant; indeed in the history of the natural sciences his rich and illustrious genius is rather fascinating than effectual. Yet, had he made natural science his field, Newton only of his fellows could have surpassed him.[2] Boyle admired Wren as a student of physics and of physiology, who had invented transfusion; to him Newton owed some debt of mathematics; even Hooke respected him as a rare mechanician. A chance comparison in Boyle of some philosophical rubbish to the "ruins of Paul's," is a vivid touch of the time; and an unconscious signal of his friend's monumental fame.

Hooke abode on the field of natural science, and thereby achieved a work in which his dwarfish and fretful nature is transfigured in our eyes. If his name does not stand in the first rank, it may be that he had more insight than pertinacity. He had glimpses of many great truths—of the undulatory theory of light; of the law of the inverse squares; of the analysis of musical vibrations. He was the first to state clearly that the study of the heavens is a mechanical problem.[3] Hooke was closely associated with Boyle, both in his physical and physiological researches. As a mechanician he translated the ideas of his time into practice with rare ingenuity. Otto Guericke was no doubt the first to make the air-pump; but Hooke and Boyle, or Hooke for Boyle, made a better one, without seeing the model;[1] as Galileo made his telescope on the hearsay of one made in Holland. Hooke invented also the balance of the watch, though Huyghens was the first to put it into practice.[2] Hooke and Grew, like Malpighi and Leeuwenhoek, worked with the microscope, but chiefly with the simple microscope; the compound microscope at that day and for a century afterwards, on account of spherical and chromatic aberration, was almost useless. I am glad that Hooke is not—so far as I know—looking over my shoulder, for I would add, in conclusion, that he seems also to have been one of the inventors of the jealous assertion of scientific priority.

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[1] Stähl, a Strassburg chemist, brought for a while to Oxford as a co-operator by Boyle. The laboratories of Boyle and Stähl were in the High Street, near University College. See R. S. Gunther, *Early Science in Oxford*, 1920.

[2] Cambridge cannot be described as a considerable mathematical school before Newton; logic, ethics, and metaphysics on scholastic lines were the undergraduates' fare.

[3] The conception of the heavens which still ruled even great thinkers, like Harvey, I have set forth briefly in my little book, *Science and Medieval Thought* (pp. 47 and *seq.*).

On Mayow I may touch with disproportionate brevity; for Sir Michael Foster has lately appreciated his work, in his *History of Physiology*. It had long been known that on venesection the dark blood turns red in the open air (p. 260). Lower—who made the first transfusion experiment, Bathurst, Hooke, and Mayow proved that artificial respiration would reanimate the heart, and redden the blood. Boyle had shown that neither combustion nor respiration could continue in a closed chamber; and Boyle, as I have said already, surmised that the air contains something quintessential to this end, which might be separable, as perhaps in Drebbel's ship, from the "carcase of the air." Mayow demonstrated that this part is even more richly contained in saltpetre, and is virtually what we now call oxygen ("fire-air," "aerial spirit," or "nitre air"); moreover he proved that the increase of weight obtained by burning a metal such as quicksilver in air is to be attributed to its combination with this element.[3] Unhappily, as beforetime the cobwebs of Duns, so the phlogiston of Stähl stopped all progress, until the birth of Lavoisier. Sir Michael Foster is disposed to put Boyle's contributions later than those of Mayow; but Mayow's earliest tracts were published in

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[1] See Appendix B, Mr. Harrison's letter.

[2] "Those accurate Dyals which go by a pendulum, and were of late ingeniously invented by the Noble and Learned Hugenius" (p. 170).

[3] The fact that metals increase in weight on calcination was well known before Mayow: at any rate it was known to Boyle, and Ray had observed it in 1650.

1668, Boyle's, from which I have quoted, in 1661. These bright spirits wrought together, on the whole without envy ; and to try to apportion to each his share in the common growth, to deal to individual genius every several part of the product of social genius, is, even in our own time, too curious an enterprise. But, at least, Boyle, Mayow, and Hooke did as much for physiology as for chemistry.

Of the greatest names of the Oxford group one remains, one on whom I cannot be silent : Locke, the loyal friend of Boyle and of Newton, who did for the mind what Harvey did for the body. Psychology, and this was one service of animistic speculations, had all through the Middle Ages lain within the scientific domain (p. 122). The late learned President of Corpus reminded us (ed. *Nov. Org.* p. 271) that the " affectus et prehensiones intellectuales " were among the objects of natural philosophy in ancient usage ; the word psychology being a neologism. Thus the *De anima* was always ranked among the physical works of Aristotle. In the old statutes of the University of Oxford, among the works on which the Praelector Naturalis Philosophiae was to lecture, were the *libri de anima*. Here I may refer also to the seventh book of the Ethics. To enter upon any adequate appreciation of Locke, were there need for a new appreciation, and were I apt for the task, would at this hour be impossible. I will content myself and you by saying, again in the words of Dr. Fowler : " There was never a thinker more wise, more methodical, more logical than Locke. Other reasoners had written a romance of the soul ; Locke came and modestly wrote its history, developing the ideas of the human understanding as an accomplished anatomist explains the force of the human body " (edn., 1881, p. 197). It would appear that Locke, on his strongest side, was scarcely understood by his great contemporaries ; Wood gives us no more than a few trivial impressions of him, characteristic as these are.

When across the centuries we admire the constellations of great " Wits "—to use their own word—of seventeenth-century Oxford, we are apt in our admiration to think that the great mother was glad in them : and so in her own heart she may have been ; but with the rest of her brood it was far otherwise. We see the Dean of Christ Church setting his poisoned traps for

Locke, and tendering his servile offices to expel him.[1] At the head of a gang of fops we see to our sorrow Hobbes, who had "contracted a morosity," pursuing the Scientific Society and its members with rancorous and pedantic censures. Thomas Sprat had to argue that experiments are not dangerous to Universities. Not only did pert young priests ask sarcastically to what purpose it is to preach to people, and go about to save them, without a telescope and a glass for fleas! but even South also, the Public Orator, at the opening of the Sheldonian, fulminated against the Royal Society. Of the Wadham College Library Mr. Wells says that such a collection enables us to realise the main interests of a seventeenth-century scholar. "Every variety of theology, historical, doctrinal, above all controversial, is represented fully. . . . Long-forgotten Jesuits from Spain or Poland stand in dusty oblivion side by side with their opponents. Hales and Aquinas are as eminent as Erasmus and Luther. Scholars from all parts of Europe met, armed with the common language, Latin, on the common battle-field, Theology."

For this monstrous trifling, this solemn pyramid-building, in the desert, over the ashes of ghosts, a sore night was at hand. In 1642 the king entered Oxford, the toga yielded to arms; the babble of the school was lost in the din of the fortress, and for four years science and letters held their breath in the crisis of the nation. Happily among the captains of both factions were men who had been suckled at the breast of the great mother, now again in travail, as the storm divided this way and that; they protected her life, but in their strife her heart was torn!

οὔκουν ὅμαιμος χὤ καταντίον θανών; ὅμαιμος ἐκ μιᾶς.

In the beginning of the eighteenth century in England Berkeley was writing the *New Theory of Vision*, and Dick Steele was founding *The Tatler*; in France Clement XI. was tearing down the walls of Port Royal and scattering the bones of the Jansenists. Fifty years later still, the implacable Sorbonne, by damning the treatise *De l'esprit*, and the indefatigable Bishop of Rome, by burning it at the hands of the common hangman, bestowed on Helvetius the uneasy crown he merited so little. Truly our precious things are often in the keeping of very pernicious persons!

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[1] Locke was expelled from Oxford by order of James II.

Meanwhile Oxford of the eighteenth century seems to the philosopher to have drifted almost farther away from us than the fourth century before Christ. In the eighteenth century the University was subsisting only upon the heritage of her great past: von Uffenbach, in 1710, reports that Boyle's "elaboratory" completed in 1683, was become the prey of rust and the worm; Mr. Wells says that, even in 1794, an attempt to form what I will call the "Junior Scientific Club" was promptly crushed by the Vice-Chancellor, and that its would-be members were dubbed "The Lunatics":[1] and so Oxford slumbered on, to be awakened, not by the hum of the elaboratory, but, as by Wycliffe three hundred years before, so anew by the thunders of Wesley, and the lightning of Newman, in St. Mary's; St. Mary's the nurse of her infancy, the venerable mother of her prime. St. Mary's and modern physical science would teach alike that between the material and the spiritual worlds there is no gulf; that in the death of either the other is also dead; and that in the life of each is their consummation. The Oxford sciences of our own day are happily too great a matter to make an end of my discourse; they are great enough to prove that—

Nature, crescent, does not grow alone
In thews and bulk; but, as this temple waxes,
The inward service of the mind and soul
Grows wide withal.

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[1] It is said that Adam Smith was thrust out of Oxford for reading Hume. Certainly he left without a degree. "Of all the Boyle family," says Miss Townshend, "only one is familiar to us to-day—Robert, the philosopher, who never made money, nor accepted a title, nor desired to rule over any kingdom but that of his own gentle spirit."

APPENDIX A (p. 498)

PETER PEREGRINUS

A GLANCE into origins reveals, among other things, the complacency with which even serious authors copy from each other. Names, phrases, paragraphs, nay, whole pages, are thus transferred word for word from old to new; the first maker of the stuff might complain, the several retailers cannot. Thus one historian after another talks familiarly of Peter Adziger as a forerunner of Roger Bacon, as familiarly as if Peter Adziger were as well known as Hales or Grosseteste. In another place we read of Peter of Maricourt, or of Maharnecourt; in another of Petrus Peregrinus. In the Library of Cambridge University, with the help of my friend Mr. Francis, I satisfied myself that if these three Peters be alembicked into one Peter little will be lost on the distillation. But we do not all copy from each other; when I had worked out the scanty records of the triune Peter, I found that my labour had been in vain, for M. Charles had done it all before in his now scarce treatise on Roger Bacon, published in 1861; about that date I read M. Charles's book, and had peradventure retained some doubts of the several Petrine impersonations of this forerunner of Bacon. But as an ancient ghost he is so interesting that I will set forth the little known of him. Under the name of Master Peter, Bacon describes a scholar and recluse of endowments and insight far beyond any of his time. Indeed, were it not for some independent testimony, one might suspect Bacon of a whimsical counterfeit of himself; so strangely alike are the portraits. Peter, too, was immensely disdainful of his kind and contemporaries, immensely intolerant of sophists and rhetoricians; moreover he was absorbed in the practice of mechanics, astronomy, chemistry, and other branches of natural science; and devoted to experimental methods—Bacon calls him "dominus experimentorum"; likewise he constructed a great burning-glass. Which one of the troop of historical Peters can this rare and mysterious Peter—"laudatus a laudato"—be? To his identity we have a clew. In more than one library of Europe, in Paris, Oxford, and Leyden among others, is extant a letter dated—in the Leyden copy—1269, at one time attributed to Bacon, but by Cave and others restored to its author, "Peter Peregrinus." The title of the letter is "Epistola Petri Peregrini de Maricourt ad Sygerium de Fontancourt, militem, de magnete." Now, Humboldt quotes, among the medieval observers of the magnet, a certain "Adsygerius," a confusion (set a-going in the Leyden catalogue of the time, I believe) of the writer of the letter with one Sygerius, to whom the letter was addressed. By the deletion of Master Adziger we advance a considerable step, for the name of this Peter Peregrinus was known to us by the quotation of this letter, which was printed at Augsburg in 1558, in the work of Gilbert on the magnet. In the letter of Peregrinus is the earliest description of the magnet, pivoted in a crystal-covered box, for "directing one's course to towns and islands, and any places in fact on land or sea." But what of Peter of Méricourt, Maricourt, or Maharnecourt—forms, no doubt, of the same name? In the *Opus Tertium*, where Bacon celebrates his master Peter, he refers to him as a Picard; now in Picardy, near the ancient abbey of Corbie, is a village called Mahanicourt. If then Peter Peregrinus of Maharicourt wrote in the thirteenth century on the magnet, we may safely take him to be no other than Bacon's master. But this is not all; there is substantial internal evidence of the identity. M. Charles points out that Bacon's Peter constructed a sphere to represent the movements of the heavenly bodies; now Peter Peregrinus speaks in his letter of this machine, and proposes to use a magnet wherewith to set it in motion. Finally, the Peter of Bacon and Peter Peregrinus both excelled in Optics, and rediscovered in the Middle Ages the burning-glass of Archimedes; to Bacon's vast admiration. But, as M. Charles reminds us, there is a profound difference between Peter and Bacon: Peter shut himself up with his machines, lived in peace, and, save for his generous disciple's tribute, died in obscurity: "Pierre tient fermée sa main pleine de vérités, Bacon l'ouvre toute grande . . . et . . . va effronter la tempête, et entreprendre une révolution dans les idées de son siècle." It was well worth while, on grounds other than historical accuracy, to work out this story of Peter; if, like Goethe, he were not ethically a heroic figure, we discover in him a shadow of strange intellectual greatness, and from his story we learn how mighty men have passed over the stage of the old world, and into oblivion, without whom the mighty men we do know would never have been. Not even Roger Bacon sprang forth into the world with a Minerva birth.

APPENDIX B (p. 522)

BOYLE'S APPARATUS

I HAVE to thank Mr. Harrison (the Royal Society) for the following letter of February 20, 1902 :

" Sir Michael Foster handed me your letter about the Boyle apparatus. The only piece of apparatus that we have here purporting to have been presented by Boyle to the Society is a double-barrelled air-pump, and the tradition is that this is the air-pump with which he conducted his famous experiments ; but some Fellows of the Society have thrown doubt upon the genuineness of the instrument. I have not been able at present to test the question myself, so I assume the authenticity of the instrument. Beyond this, however, I am not aware of any apparatus of Boyle's having been bequeathed to the Society."

MEDICINE IN 1800[1]

The Editor has asked me to describe the state of medicine at the beginning of the nineteenth century, and has pointed out that the works of Cullen are worthy of regard as a monument of that time. Cullen's *First Lines of the Practice of Physic* was published first in 1769, and went through many subsequent editions until in 1827 an excellent edition of Cullen's works was published in two volumes by Dr. John Thomson of Edinburgh; this edition I have used in the preparation of the present article. Cullen was born in 1712, and died in 1790.

In the history of thought we find that after periods of extravagant speculation, whether in the direction of realism or of mysticism, or indeed of a sounder philosophy of a literary or academic kind, a phase of "common sense" sets in. With this phase, if he come to hear of it, the ordinary man is delighted, for he thinks that by common sense is meant his prevalent notions; wherein he is grievously mistaken. Common sense is not vulgar sense, nor does it deal in commonplaces; on the contrary, common sense means that which is contrasted with special sense; it is a sense of relative values, a delicate appreciation of many conflicting and contingent facts and principles, so that, in the atmosphere of all the ideas concerned, each has its own perspective. What is gained in breadth of touch, in balance and moderation, may be lost in ingenuity or in passion; so that in times of this common sense there is often a lack of inspiration, nay, even of penetration of the mind; things are shepherded together, and gains are counted at net values. The bent of such times is to a broad and critical rather than to an intense and creative purpose; such was the character of the eighteenth century, and so it was that at the beginning of the nineteenth century criticism was stronger than creation. The kind of creation which distinguishes our own time is that inspired by the experimental method; but this method, although established in physiology by Harvey, Haller, and Lavoisier, did not get into full swing till the latter half of the nineteenth century.

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[1] Reprinted by request from *British Medical Journal*, December 29, 1900.

The immediate effect of Harvey's discovery of the laws of mechanics in the field of the animal body was to impel men, not to common sense, but to a vigorous exaggeration of the new point of view: every function was to be calculated as mechanical; and thus arose the "iatro-mechanical school." Under a like impulse, deriving from the chemical discoveries of Boyle and his followers, an iatro-chemical school sprang up. Nay, more strangely still—though by no means without precedent—men turned to opposite extremes or reactions, and from these more positive conceptions swerved off into realism of the most extreme kind, as in the animalism of Stahl, into the refurbishing of old *a priori* principles such as the sthenia and asthenia of Brown, or into mysticism as involved as that of Hahnemann, a characteristic product of Germany. Chemistry however was much behind mechanics and hydrostatics, and had not advanced so far as to obtain a ready acceptance for iatro-chemical doctrines; chemical principles, indeed, formed little part of these doctrines, which consisted rather in a preference for mineral before galenical drugs. The cardinal function of respiration, for instance, which might have taken a greater place in the chemical theories of the day, was strangely neglected; in the institutes of medicine, as we see in the works of Cullen, even the discoveries of Priestley and Lavoisier were left almost unacknowledged. In Cullen's attitude to his great contemporary Lavoisier, in his indifference to a revolution in physiology as great as the discovery of the circulation of the blood, the reader may be reminded of the attitude of Bacon to Harvey. For Lavoisier Harvey's discovery had been waiting; without it the function of sanguification was unexplained (F.L. p. 260): yet in Cullen's physiological chapters the animal heat is referred to the motion of the blood—not to the friction of the blood, either in its channels or in its own particles, which by some perverseness is deliberately excluded—and the respiration is deliberately excluded. "The breathing animals," says Cullen, "are the warmest; but that they are warmer because they breathe is not more probable than that they breathe because they are warmer."[1] Herein we see that Cullen was far behind even Boyle and John Mayow, who lived a hundred years before him.

The iatro-chemical school then was in no great vogue in Cullen's day; and Cullen himself was a loyal adherent of the mechanical school. I have said that the impulse given by Harvey to a mechanical physiology was powerful enough to last even into our own century; its chief strength, as might be expected, was in Padua and in the other Italian seats of medical learning. In England the iatro-mechanical school never won a firm footing; but Archibald Pitcairn (1652–1713), the author of the *Elementa physico-mathematica*, advocated its doctrines in Scotland; and may have bequeathed some tradition of the kind in the Chairs of Glasgow and Edinburgh that Cullen successively occupied. But, if we may judge from internal evidence, it was rather from abroad that Cullen drew these opinions. Like all physicians of his time he was influenced by Boerhaave of Leyden, though he did not hesitate to contradict his master and to attach himself rather to his disciple, Gaubius, a sensible eclectic physician whose name will enjoy no long immortality. Boerhaave's reputation in the first quarter of the eighteenth century has truly been called "stupendous"; perhaps no physician ever enjoyed a fashion so much greater than his scientific merit; yet it is difficult to say wherein Boerhaave benefited medicine save notably by his pursuit of practical clinical teaching in hospital wards; and herein he seems to me to have shown less insight and skill than his pupil van Swieten, and less power of clinical observation than the memorable succession of English physicians that is but indicated by the eminent names of Sydenham, Friend, Mead, Huxham, Fothergill, and Pringle. However Boerhaave, chiefly by virtue of his distinguished personal character, was a prodigious leader, and reigned alike in the kingdoms of physiology and in medicine, studies which were scarcely differentiated till our own generation. It is not easy to see that Boerhaave held anything of the spirit of Harvey; he seems to have made no experiments, and, in his writings at any rate, to have contented himself with hashing up the partial truths and the entire errors of his time. He was essentially an iatro-mechanic, and this chiefly on mere disputation; a bad example. And in the ranks of the iatro-mechanics was a greater than Boerhaave, namely, Frederick Hoffmann of Halle. While Stahl at the same university was proclaiming a doctrine of the soul, as a biological principle, in terms of which Aquinas and van Helmont would have been ashamed, Hoffmann was devoting far greater powers of mind in constructing a theory of life on geometrical methods. Whether through Gaubius or more directly, Cullen drew much of his mechanical physiology from Hoffmann. In this view the body is a hydraulic machine: its inward mechanical movements cause its heat—are not merely co-operative thereto; by its velocities the blood expels humours and obstructions; the brain is the centre of tonus, and a nervous fluid permeating the intimate structures carries energy with it; the body is made of a "mixt" of water and gluten ("tissues" were unknown till Bichat's *Anatomie générale*, 1801) the proportions of which accounted for degrees of elasticity, flexibility, friability, etc. (*debile laxum, debile tenerum, debile fissile*, etc.) in health and disease; its connective and vascular parts by their pressures govern growth, activity, and death; it observes rhythms, as do other moving masses, hence come critical days and periods, such as sleep and menstruation; in the fluctuations of nervous energy, spasm and atony arise, and are causes of many, and, originally, perhaps of all diseases; fevers and inflammations are directly due to a flogging of parts of the brain or other organs by the rebellious blood, which breaks out into guerilla wars in this region or in that (inflammation and fever); and so forth. All this is, of course, mere dialectic; of experiment there is not a poor ha'porth. Still Hoffmann saw what Boerhaave did not see; he saw that pathology is an aspect of physiology, a view then novel enough; he did something also for neuro-muscular conceptions, and something more for the circulation in the arteries; but for biological categories—for distinction between life and non-life, for the difference between the organic and the inorganic, for insight into nutrition and secretion—the world had to wait till all these men of notions were superseded by the men of experimental verification; to wait, in a word, for Bernard. But what of Haller, a brilliant and distinguished man of science, a true experimenter, and a cautious reasoner? Well, although his *Elements of Physiology* appeared in 1757–60, for these forgemen of general notions Haller might never have existed! Into Cullen's other works some of the Hallerian teaching seems to have found its way, perchance by the eclectic Gaubius, but of the method and spirit of the great man we find little. Even Bichat was anatomist rather than physiologist; and, if Haller's inspiration failed to fashion Bichat, we shall look in vain for its manifestation in smaller men. Thus was it that Haller in the eighteenth century always seems to me to have been something of a *vox clamantis*; and I repeat that for the hearer of Cullen's physiological lectures Haller might never have existed! This hollowness makes the medical writers of the latter half of the last century and the beginning of this seem farther from us than even Galen himself, in whom, as F. J. Payne rightly insisted, the true spirit of experimental science was awake.

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[1] *Cullen's Works*, ed. Thomson, vol. i. p. 203.

If Haller was thus neglected, what of the equally great Morgagni whose celebrated letters on the seats and causes of disease were published in 1761, twenty years before Cullen's *Practice of Physic* appeared? An eminent writer says that Morgagni's great work "made pathological anatomy a science, and diverted the course of medicine into new channels." Would that it had! Again the reader may peruse Cullen from cover to cover and fail to find out that Morgagni had ever existed. As Haller had to wait for Bernard, so Morgagni had to wait for Laënnec and Bright; disciples worthy also in this that, like their great forerunner, they never forgot that, for the physician at any rate, pathology can be studied profitably only in connection with clinical medicine; and thus in them it was preserved from the scholasticism of the great Rokitansky. Even Matthew Baillie can hardly be acquitted of some forgetfulness of this truth—that only in the combination of the two points of view—the clinical and pathological—can medicine find its safety.

The tendency of iatro-mechanics was, as might be expected, away from spirits and humours and towards solidism. The deposition of Galen's humoralism was a gain, and the tendency to express living processes in terms of "movements" was wholesome. Of modern molecular physics of course Cullen had no conception, but often of intimate processes he uses the word "movements" in no unscientific manner, far more scientifically than in some recent speculations. The fault of the iatro-mechanicians was not that they pressed mechanical conceptions to their utmost applications, this is a sound use of analysis, but that they argued about them instead of testing and measuring them; even Bichat was apt to forget that after mechanical categories are exhausted other categories come in; and that after chemical categories in their turn are exhausted yet other processes remain, for the interpretation of which neither chemistry nor physics has ere yet given a sufficient explanation—those which for the moment we call vital. In a sense fashionable to-day, all these phenomena are at the bottom "mechanical"; but in my opinion much misunderstanding is caused by extending the word "mechanical," beyond the movement of masses, to the movements of molecules and of atoms. When Cullen and the iatro-mechanical school tried to explain life and disease by mathematical and physical conditions and moments their arguments were not alien but inadequate.

I have said that in the eighteenth century the chemical school had less ascendancy; chemistry was then not understood sufficiently well to be used readily in physiological conceptions. In his eclecticism however Gaubius dealt a little in chemistry; he attributed certain diseases to "acrimonies"—a word often in use at the time; and he said, not without shrewdness, that vegetables are apt to run to acrimonies (acids), but animal foods rather to ammoniacal putrescence, an opinion in which Cullen followed him; though Cullen protests against too ready a belief in hypothetical acrimonies. We begin to hear also of the "cacochymies" with which, under the name of "crases," the school of Rokitansky made so great play. Cullen is not far wrong in declaring that the chemiatrics of his day had become frivolous and hypothetical;[1] that they were not "chaste" enough to avoid baseless speculation; yet in a neighbouring page he does not hesitate in his turn to try by mere ratiocination to ascertain the causes of hunger, thirst, and other organic sensations.

With all its limitations however the mechanical physiology made for moderation, and discouraged extravagances. As I have said, Cullen is a model of good sense, even in his philosophy. His own hypotheses are set forth with modesty and "chastity." When he asks his hearers to grant him a moment for *lusus ingenii*, he warns them that they will bestow their time upon these at their peril. On the other hand he says well that to profess to avoid all theory is mere talk, and to preach practice without theory is "specious but impracticable"; that every man has his theories, good or bad: weak and ill-trained minds have frivolous or dangerous opinions, their facts are as false as their reasons, and they do not know where to stop. Even Sydenham, whom Cullen honours, had his hypotheses, and bad ones; but he held them, says Cullen, in a light hand, and did not allow them to blind him in practical matters. For, as Cullen goes on to say, mere empiricism is an impossibility (F. Lect. p. 167 *ff.*); to huddle facts together without construction is but confusion; it is true that we must reason as we observe: yet observation is fallacious, man variable and peculiar, the work of Nature secret and complex, the lack of facts lamentable, and our slavery to words pernicious. Thus, for example, Cullen's criticism of the current teaching on "temperaments" is admirable and characteristic; treat of them he must, but mainly to declare that the whole matter is smothered with the doubtful guesses and untrustworthy descriptions of men who could observe only through the medium of their prepossessions. We are not surprised to find that Cullen leaves little of that fictitious structure standing. Yet, while thus positive and shrewd, and lamenting the lack of authentic facts, Cullen tries to supply their place, not by more scientific observation and experiment, but by more arguments; arguments which differed from those of other teachers only in their greater sobriety. He did not see that, in physiology as in other sciences, by experiment only can a body of law be obtained. For instance, he thinks well of cold water treatment in fevers, and wishes that by a thermometer the method could be made more precise; yet it does not occur to him to try; although Haller had set him the example, he prefers to argue on. In his criticism of the *vis medicatrix Naturae* is an instance of Cullen's "common sense." He points out that, although Nature is a moving system tending to readjustment and liable to disturbance, yet to attribute to this system of causes an intention of cure is no less a vice than to assert that all natural processes are good. He does not hesitate to say this trust in "Nature," if useful in a protestant time, brought an element of weakness and timidity in practice upon Sydenham, as it had done indeed upon Hippocrates himself.

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[1] See Harvey's opinion, F.L. p. 317.

Let us now turn from Cullen's physiology to his *First Lines of Physic*, and see how he treats this subject. The influence of the great Linnaeus, then in the ascendant, led his contemporaries to press even to greater extremes the logical classifications which had their origin in the Aristotelian scholasticism; and, like many worse men, Cullen was impressed by the fallacious notion that diseases, like plants and animals, are susceptible of arrangement into genera and species; whereas of course diseases are not individuals, but various states of individuals. Being qualities, not things, they can no more be divided into genera and species than colours can be.

Cullen divides diseases into two main classes—namely, Pyrexiae and Neuroses. The Pyrexiae he divides into Fevers, Inflammations, Exanthemata, Haemorrhages, and Profluvia, In their observation of fevers—*morbi sine materia*—the elder physicians were at their best. Cullen takes intermittent fevers as the type, remittents as aberrations. Continued fevers are another kind, which he divides naturally enough into the "inflammatory" and the "nervous"; by the latter those are signified which, affecting the nervous system, manifest tremor, coma, prostration, etc. For the inflammatory fevers (many of which, as he admits, are symptomatic) he knows no causes but his "phlogistic diathesis," of general or local manifestation; a god that he brings many a time out of his machine. The delirium of nervous fevers he attributes to "an impetus to the brain"; though, on remembering that such impetus must occur in violent exercise also, he is a little bothered; but everywhere in such difficulties he not only avoids the hypothesis of toxic influences, but frankly prefers his mechanical hypotheses as less visionary. He recognises however the poisonous effects of overcrowding, as in gaols, etc.; and also those of miasmata (ground effluvia); but, except in gaol fever and intermittents, he gives them no great part in disease. He notes curiously the comparative immunity of scavengers. Hectic fevers for him rightly denote suppuration. The inflammations whether ophthalmias, cynanches, gastritis, hepatitis, nephritis, or the rest, are of course local rebellions of the blood in this part and in that. *Nephritis vera* or *idiopathica* he admits, but dwells chiefly on that due to calculus. He notes truly that in rigor the temperature is rising, and that constriction of the superficial arteries is a part of the process, but proposes a fanciful debility as the immediate cause of the attack. By the way, on pp. 42-44 of the second volume we may find sufficient evidence of the prevalence of diphtheria within the sphere of Cullen's practice.

The class of *haemorrhages* is a very heterogeneous one ; it contains epistaxis, haemoptysis, haematemesis, haematuria, menorrhagia, leucorrhoea, piles, etc. Under haematemesis we find in Cullen practically no pathology ; liver obstruction is doubtfully suggested, and some ulceration of the stomach supposed to be "possible."

Phthisis pulmonalis comes under haemoptysis, and with this disease he deals in a remarkable way. He contests the wisdom of sending these patients to warm climates, and of coddling them ; on the contrary, he recommends plenty of fresh air, if possible by sailing on the sea. Mercury and much bleeding, even in the highly febrile stages of the malady, he is sure is mischievous. Finally, he tells his pupils that they "will discover nothing satisfactory in books" for the treatment of phthisis, and he wishes he had "the time and the genius" to work out a better treatment. He is clinician enough to be assured that tubercle—a "noxious acrimony"—is almost without exception the cause, not the consequence, of haemoptysis. He traces phthisis to dusty occupations also, as in stone-masons, flax-dressers, and others. He urges that there is too a kind of phthisis attributable to calcareous deposits, for in some cases he has seen such matter voided from the lungs. For the amenorrhoea due to phthisis, he was wont to elude, by some "pious and innocent fraud," the emmenagogues for which he was usually importuned. Balsams for the cough, in his opinion, disorder the stomach, prevent nutrition, and are after all of little use.

Of other pulmonary and of cardiac diseases Cullen has little to say that need detain us, for of their pathology he had hardly a glimmer ; he does once allude to a hepatiform change in the lung, but of this fact he makes no use. The solitary jewel in the chapter is his recorded necropsy, whereby he proved that perihepatitis may simulate a pleurisy. (We must remember that when Cullen published his *First Lines* Matthew Baillie was only about sixteen years old.) The discoveries of Avenbrügger are noticed once or twice, but to no advantage ; in this respect Cullen was no worse than his neighbours, for not till the genius of Laënnec revealed the methods of physical diagnosis was justice done to the great Viennese physician.

The second chief class of diseases—the *neuroses*—is no less heterogeneous and inconsistent; founded no less on very superficial resemblances and analogies. First come the Comata—apoplexy and palsy. Then the Adynamiae (consisting in a weakness or loss of motion in function); these are syncope, dyspepsia, hypochondriasis. The third sections are the Spasmodic affections without Fever; namely, tetanus, epilepsy, chorea, palpitation, dyspnoea, asthma, whooping-cough (recognised as contagious), pyrosis, colic, cholera, diarrhoea, diabetes, hysteria, hydrophobia. Cullen is at his best in subjects for which a sagacious observation and large experience are most effective. Thus he is well equipped for dyspepsia, which he perceives to be often a secondary affection, for syncope, and the like. Hypochondriacs, he shrewdly tells us, are not to be driven out of their position by reason or raillery, but by artifice and stratagem. In epilepsy he recommends the ligature of a limb above an aura; he distinguishes those attacks wherein the spasm is partial in its origin, and consciousness often not lost; and he recognises the evil of repetition of attacks of nervous disease, as tending to form a habit. The *Vesaniae* make an important division, and, as now, so then, they lent themselves to mild philosophisings and literary descriptions. In mania control by " awe " is a therapeutical means not to be forgone, and thereunto " stripes " should be cautiously exhibited; advice for which there was no need. (William Tuke and Lindley Murray called their meeting to found the Retreat at York, and to return to the principles of psychiatry of Greek Medicine, in 1792; about ten years after the first edition of Cullen's *Practice of Physic*.)

Headache is inserted next by Dr. Thomson from the *Clinical Lectures*. " As a disease," says Cullen, " it is obscure, as a symptom difficult." He objects to attribute it to the " acrimony (acidity as we call it) suspected everywhere, even in the nervous fluid itself." His description of megrim is good, especially of the pulse in this malady; but in treatment he is not so good as he might have been; he mixes simple headache with organic disease of the brain, and satisfies himself with such words as " topical fever." He recommends low diet, cold bathing, and avoidance of debauch and fatigue. Of other divisions, such as Cachexias, Emaciations, Intumescentiae (including adiposity, flatulence, dropsies, and even rickets); and of Impetigines (including scrofula, syphilis, scurvy, jaundice—he denies "haematogenous jaundice" but had for the most part gall stone in his mind) we have not space to treat incidentally, interesting as are many of the parts; but the essential confusion of his explicit classification is such that his best paragraphs can be regarded only as *obiter dicta*. As gout must be either a "spasm" or an "atony," it appears as an atony of the stomach.

On therapeutics Cullen is on the whole negative and pessimist. He does not by any means give up bleeding, but is cautious and sparing in its use; he has seen much harm done by its large and routine use in all kinds of patients, and especially in the convalescence which, after free bleeding, is apt to be delayed by weakness and anaemia. In rheumatic fever he notices this disadvantage, as indeed did Sydenham himself; and he advises the practitioner to be content with woollen clothes and the new "Dover's powder." Of purging, he has even less favourable things to say, unless there be a "cold and bound belly," from which he reasonably thinks infection may arise. The passions of the mind are to be mitigated in illness, a measure which he "leaves to the philosophers, or, if you will, to the divines." He also promotes for good the wholesome conditions of life, urging in the prevention and relief of disease the temperance which he never forgets in his philosophy. Concerning drugs Cullen speaks with a wise reticence and mistrust: many are the deceptions to which we are liable in estimating their effects; indeed he leaves few galenical reputations standing. On the one hand he feels that art is needed as well as Nature; but, on the other, experience did not strengthen his faith in medicine as it was in his day. Our impression of it all is that his patients had an eminently judicious physician who would make few mistakes, but inspire no confident hopes. The divorce of surgery from medicine was as unfortunate in Cullen's time, as in all other times; for, in the positive and experimental work of the Hunters and the Munros, surgery was then making the way for the regeneration of medicine. The modern reader of Watson's *Lectures* (published about 1840) may wonder at the vast distance between Watson's standpoint and his own; but in Watson's generation physicians had at least assimilated much of the teaching of the morbid anatomists (Morgagni, Baillie, Bright), and of the great French school of

Laënnec, by which the art had been transformed. Out of these materials was being built a comprehensive and scientific method in which the thoughts of a teacher of medicine were dictated by likenesses and differences of a far profounder kind than were recognised in the time of Cullen. If to us Watson seems far off, the vista of the half century from Watson backward to Cullen seems so much farther as to carry us not into a previous generation, but, as it were, into a previous age. Still it is true that by his sceptical and cautious temper Cullen prepared the way for the new constructions ; he sapped the foundation of the old medicine, and dismissed the philosophers. In discussing mental disorders he could not but allude to such thinkers as Descartes and Leibnitz, but he calmly says that their systems explain nothing, and, if admitted, have no application in medical doctrine. Of the experimental method, of pathology human or comparative, of embryology, or even of evolution itself, Cullen knew nothing ; but of the old conceptions, to be destroyed for the new, Cullen proclaimed the emptiness. And one great reform he did promote, a reform yet far from consummated—he dethroned Disease and set up the Patient ; he distrusted systems, and saw that the only real is the individual. Another example he set which it were well that we should imitate : he thought with vigour, discernment, and accuracy, and therefore wrote with lucidity, proportion, and correctness. *O ! si sic nostra !* If Watson's admirable style may be at times a little precious, if the labour of his file is sometimes to be overheard, Cullen so far writes better than he. The careless reader of Cullen, who runs and reads, does not know how much had gone to that insight, shrewdness, limpidity, and verbal precision. And, as a summer lightning which is everywhere and yet nowhere, there is within all his reflections a keen sense of humour ; but the humour of an artist who will not sacrifice his art of perfect expression even for a witticism. Cullen was not a great man, nor even in his own sphere a scientific man ; there were many fruitful things within his reach of which he was too sceptical to see the promise ; but he was eminently one of those in whom *initium sapientiae est stultitia caruisse.* And yet this lucid and temperate spirit had scarcely been gathered to his fathers when the chimera of the disputatious and disreputable Brown caught the fancy of half Europe. Such is the irony of history !

MEDICINE IN THE TWENTIETH CENTURY[1]

Though the plans of this special Clinical Meeting of the British Medical Association—held for the purpose of bringing to the minds of all of us by way of discussion and demonstration the lessons learnt in the war—do not include the delivery of addresses, it seems becoming that I, who have the fortune to be the President of the Association and of the meeting, should present to those attending it some words of welcome and some thoughts that have long been dwelling in my mind.

That we meet together to-day at the greatest moment in the History of Medicine seems an audacious claim; how shall it be justified? Not only because this is a gathering of physicians of commonwealths, dominions, colonies, and allied and friendly nations to consider the lessons of a great war, great as such an occasion is; not only because the medicine of modern nations and empires has vindicated its ascendancy during the greatest war of all time, but also because at this moment it is revealed to us that Medicine has come to a new birth, and in this regeneration has fought on no unequal terms with other arms in a glorious campaign. It might have been supposed that in war there would be no time to think, only to do; but we are surprised to receive from the great caravan of our returning pilgrims enormous gifts to medical science.

In former wars death by disease were many times more numerous than by battle; even four or five times more. In South Africa the enteric fevers were more destructive than battle; in this European war this disease, owing to scientific prophylaxis, became almost a negligible factor. Indeed in the West the average health in camp was even higher than at home; and in bad quarters such as Salonica or Mesopotamia, principles of pathological biology were put in action—as they were in Panama—which brought infections down as low as time and occasion could permit.

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[1] An Address to the Members of the Special Clinical and Scientific Meeting of the British Medical Association, London, April 1919. Also republished by request.

The New Birth of Medicine.—What is then the new birth, this revolution in medicine? It is nothing less than its enlargement from an art of observation and empiricism to an applied science founded upon research; from a craft of tradition and sagacity to an applied science of analysis and law; from a descriptive code of surface phenomena to the discovery of deeper affinities; from a set of rules and axioms of quality to measurements of quantity. When I turn back to the medical textbooks of my pupilage, to the wise and scholarly Watson, or the respectable Alison, and contrast them with the textbooks of to-day, I marvel that a change so vast, so profound, so revolutionary, should have come about in one life-time! Many a generation had to pass before Harvey's researches established animal mechanics; many again before the half-lights on animal heat of Willis, Mayow, and Boyle were brought to quantitative verifications. In Medicine observation cannot carry us very far, not so far, let us say, as in astronomy; and skill and sagacity, if they do not die with the individual, keep in the axioms and exercises of the school but a transitory life. No observation of a thunderstorm could unravel its affinities to the action of a loadstone on a scrap of iron; no observation on diet could reveal the relation of food protein, by way of the amino-acids, to the tissues; no observation bestowed on scurvy or beri-beri could detect the occult and elusive but all-potent influence of the vitamines; no observation of secretory and muscular action could reveal the play of surface tension in muscular contraction, nor its relation to lactic acid and oxygen. By what sagacity could the shrewdest observer, let us say of heart disease, perceive the likeness of the formations of a soap bubble, or a raindrop, to the contraction of a muscle fibre in terms of its length; or that muscular contraction is not so much a chemical as a physical system with a negative temperature coefficient? Again the relation of the hormones to the development of men and women, and to the phases of their respective organs of growth, function, and of reproduction, is an issue of the academic laboratory. The prodigious harvest in the present campaign that Medicine has reaped from the original researches of a chemist into the occult causes and laws of fermentation by microbes, and from a field apparently so alien as of the silkworm disease, we are now celebrating.

Science and Practice.—One of the main lessons of our history has been that, in neglect of research into truths below the surface, Medicine, for lack of a deeper anchorage, has always sunk back into empiricism and routine. Thus the great period of Ionian scientific insight, with its Hippocratean medicine and surgery, waned until the new birth of science and medicine in Alexandria, as reflected for us in the pages of Celsus. Then, as research languished, the drift was downwards again to rule of thumb and recipe therapeutics; though once more by the physiological researches of Galen it was transiently lifted up until the obscuration of all science in the long Byzantine and medieval eclipse.

Yet, even during this period of second-hand knowledge down to Paré and Wiseman, medicine was at intervals stirred in its sleep by adventures of surgery which, then as now, carried a certain turbulent and provoking inquisitiveness into the complacent pomp of its medical tradition. And let us not forget how many of the greatest men in medical history, from the wars of cloud-topped Ilion, to those of Greece, of Rome, and of modern times, had been on military service.

That every cell in the body is a microbe producing its own secretion, which we may call secretion, hormone, or toxin according to our regard of its values—some indeed such as trypsin being beneficent in certain relations, maleficent in others—is now apparent; and these several specific energies are gradually being reduced to experimental measurement; quantities upon which is being built that large and growing system of reinforcement and inhibition which, in its applications in this war, has saved more lives than the sword has slain. The skill, sagacity, and aphorisms of Hippocrates, the skill, sagacity, and aphorisms of Sydenham, did useful work for mankind in the twilight. In the great hospitals of England skill and sagacity, qualities in which the English physician is unrivalled, are eminent at the bedside and in the classroom. In no country has the pupil been so well taught to make use of traditional and empirical knowledge, to apply this handy knowledge, quickened eye, and clever resource to immediate necessities. But to-day physiological and pathological science is running too fast for this medicine of individual and empirical authority, medicine which formerly I have described as up to date but not beyond it ; the medicine of the day but not of the morrow ; the studentship of the diploma but not of the university. Now we have to stint even this moderate commendation ; the advances and accomplishments of the ancillary sciences are becoming too swift, and too exacting both of time and training, for the clinical worker to keep pace with them, or from them to select fertile principles for application to his immediate work.

No man, be his faculties what they may, can be at once physicist, biochemist, pathologist, practitioner, and sanitarian ; yet he has to treat—let us say—dropsies on principles of osmosis, diabetes on those of biochemistry, anaemias on those of physiology, malarious, yellow, and trench fevers on those of minute parasitology ; and so on.

The working physician cannot be a biochemist, nor a biologist, in the academic sense of these studies ; any more than an engineer can in this sense be a mathematician or a physicist. Without academic study the engineer had by rule of thumb built bridges, towers, and aqueducts, if simply and rudely ; but, as far more than this is now required of him, so far more is required of the physician. Without physics and biochemistry we cannot find nurture and growth ; from the breasts of these nursing mothers we likewise draw our life. Disinterested academic students of biology and biochemistry, if not indifferent to practical needs yet unchallenged by them, have been and still are, working on larger and remoter issues ; pregnant indeed with the future but in some isolation from the feats of the clever craftsman—surgeon or physician—dealing in a tentative and empirical way with conditions that will not wait. The scientist is in a balloon and his outlook spacious ; the eye of the craftsman is quicker for contingencies but his survey narrower ; the craftsman sees the trees, the academician the wood ; neither has put into common stock all he should give to the other. But the academician, recognising the fertility of practice in new and diverse problems, is keener to co-operate with the craftsman than he with the other.

Need for Mediating Machinery.—Between these departments of research and practice there is needed a mediating system; a technical school continually to co-ordinate the growing principles of the laboratory with the accumulating contingencies of practice. As I have said, the busy practitioner cannot be a master or even a disciple of these several departments of science, yet he must be so instructed in the broader principles of them that he shall be not only in a position to recognise their applications to practice but, if he is to be a teacher, to perceive moreover the emergencies of these principles in their several fields, so that he may apply them to his own industry and foresee wider and wider occasions for such applications.

To genius we can set no bounds; but I have asked myself sometimes if Lister would have worked out his great research if, instead of being in Edinburgh, he had been in London. Why should he not? Well, because in Medicine London is but a factory; Edinburgh is besides a technical school with its technical professoriate animated by an academic spirit. When my pupils leave Cambridge for London, imbued I hope with some scientific ideas, and somewhat enlarged in scientific imagination, they begin there to lose much of this outlook, much of these ideas. Fascinated, as justly they are, by the practical wisdom, sagacity, ripe experience, and clever resources of their medical and surgical teachers—for as practitioners, I repeat, these are the best in the world—the pupil loses vision of Medicine as a science. He returns to us for examination an excellent apprentice, but no longer of the company of the prophets. For a diploma, for the doctoring of the day, he is good; from an academic standpoint, from an outlook to the medicine of to-morrow, from a vision of the continual carrying and weaving of the yarn of biochemistry and biology into the web of his art, he has fallen away. For him the future lies undisturbed and unquestioned; the spirit of curious investigation has evaporated. As I have said on former occasions, Harley Street is the grave—shall I not say the cemetery?—of clinical research. How many a brilliant colleague who as a Professor of Medicine, Surgery, or Gynaecology would have shed light upon his profession and his school, yearning it may be for a sphere of research yet, finding no other career or means of livelihood open to him, has been driven to throw up all this mediation between his art and its sciences, all effort to tear her secrets from Nature, all hunger for things to come, and to bury these talents in practice.[1]

These reflections may seem unfit for a world audience, more appropriate for a domestic homily ; but, from the school which I know best, I tell a tale which is of universal application. I return to the great occasion on which we are met. By this war, whether doctors or combatants, we have been thrust into new problems ; we have been shaken out of mere readiness of resource, mere experience, mere sagacity, and compelled to that new curiosity, that passion to wrest new secrets from Nature, which fortunately had made some way before the war ; which was then turning Medicine from an observational and empirical craft into a scientific calling. The Committee for National Research, established in 1913, was one mark of this change, and in our crisis has shown itself as the spirit and the organ of advances which I have been tempted to call stupendous.

Sometimes it is said that to carry instruments of precision to the bedside blinds the student ; that in fadding with instruments, even with the stethoscope, he forgets the use of his eyes. Is it true that instruments of precision, while opening the eyes of the observer to deeper and less obvious processes, closes them to the plainer features of disease ? Surely the chief differential features of—let us say—tabes dorsalis were as manifest to plain observation before the advance of scientific research as they are to-day ; indeed the chief work of my old master Duchenne was of a descriptive kind, well within the range of unassisted vision. Why was it left to Parry and Graves, not a hundred years ago, to describe Exophthalmic Goitre ; or Myxoedema to Gull and Ord ? The tests known respectively by the names of Babinski and Kernig were within the reach of the physician before the pyramidal tracts were dissected, or the pathology of basic meningitis laid bare. Why was it left to our own day to distinguish typhoid from typhus fever ; or Hodgkin's disease from Scrofula ? The truth is, the spirit of research, far from dimming the eye, quickens it. In science there is no place for skipping. Look but aside and Nature gives you a cuff on the cheek. If the hasty student prefers his stethoscope to his eyes he is soon pulled up, if not by discipline, by Nature herself.

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[1] This address was written before the cardinal change of 1920 towards a hospital professoriate was established.

Research is the salt of the most practical training; it cannot begin too soon; it is the light of the wisdom of the man, of the mind of the boy, of the heart of the child. Education has lingered so long on Hellenistic and Scholastic ways, on the systems of abstract notions unvexed by verification, that the hard-shell practical man is still occupied by the notions of antiquated theory, and the phrases of a dead or moribund nosology. The majority of medical men have to work upon the store of scientific ideas and facts with which they set out in practice; onwards they may gain in adaptiveness and technical facility, but can dig little deeper into the strata of knowledge; but for the modern academic spirit this would spell, as in history it has spelled, stagnation. Therefore it is of the greater importance that every student should start on his career well equipped with scientific principles. If, thus equipped, he be not at first so handy a doctor as his seniors, yet with his larger mental grip he will soon pick up common devices and apply them with more freedom and economy.

On the other hand, it is right that the working doctor should refuse to be jumped too readily by the new lights. He has long been scouting his way in the bush and tangle, and has gained a certain pathfinding instinct; he is responsible for the safety of his patient, and has to see that he comes to no harm by overdriving of principles untempered by a sense of contingencies, a sense with which the English doctor is richly endowed. Notwithstanding, no man can deal well with a very complicated subject, such as medicine, without a strong underlying framework of precise knowledge; and it is as knowledge becomes quantitative that solid progress is made. Happily this greater precision, far as it is from fulfilment, is manifest enough in the work of our own generation to give us encouragment.

Medicine and Physics.—Let us glance, however hastily, towards some of the paths on which we go to meet new knowledge. In the venerable study of anatomy in its static aspects the student has long been taught the value of precision; but the recent tide of anatomical study towards its dynamic aspects, as by the work of Sherrington and Head, is bringing in new currents not of theory only but also of practice. Of other casements opening upon new visions of medicine that from the chambers of Physics is perhaps the most arresting; at any rate at present. How fascinating, in their application to pathology, are the principles of osmosis with its curious reversals, of surface action and adsorption, of electrolytic differentials and electric methods of taking quantitative measurements, of mechanical pressures in the circulation of body fluids and, in the heart, as measured and graphically delineated by Hales, Ludwig, Gaskell, and Mackenzie, of the behaviour of fluid veins, and of the relative diameters, normal or variable, of the cardiac chambers and their main outlets. I need not do more than allude to the recent work on the CO_2 tension in the pulmonary alveoli, and to its immediately practical bearings on so-called acidosis, on the treatment of persons gassed in military or civil operations; and so forth. By physics again we are shown, especially in plants, how in life the less complex molecules are working not only in planes below those in which the higher functions are developed, but upwards by pacific penetration moderate where they do not command. How instantly such researches as these must govern the practice of medicine we perceive, for example, in the gum-saline treatment of surgical shock. It would seem indeed that some of the most mysterious phases of immunity and anaphylaxis, of phagocytosis, and also of narcotism, may depend, at any rate in great part, on surface action; and that the behaviour of lipoids released from disintegrating proteins may lower surface energy, as in the retention of water in renal dropsy; or again in a different field may determine the touch or the permeability of synaptic neurons. These, and such physical laws, as they are revealed to us, teach that in the multiplication and co-ordination of surfaces, let alone their chemistry, are operations which do not arise in mere mixtures of the same ingredients. A surface may not be accessible to molecules of all liquids. If accessible to a molecule of water it may be inaccessible to one of chloroform. The laws of selective absorption, as revealed in incandescent vapours, might throw some light upon those of biology; for in both fields we have to study vibration of molecular systems in unison, harmony, or discord.

It is for the artist to create and construct, but for the scientist to analyse and separate the elements of form, and to verify them by partial syntheses; and these physical and chemical categories —improperly called "mechanical" seeing that they are self-active and self-constructive—we have to exhaust before we search the skies for a " vital force." One chief direction of our work must be to find methods of serially reducing these planes of functions one by one, so as to suspend inhibitions stage after stage, and, by taking it to pieces, to reveal the construction of the organism.

Medicine and Biology.—When we rise from physics into systems of biological activity two conceptions especially strike us as new and marvellous; namely, those of the colloids and of the cell. But throughout these systems we shall find the physical phases, if no longer constructively dominant, yet still active and effectual. We cannot even guess at the links of these chains where physics recedes and biochemistry takes the lead. The mere size of the molecules now concerned alters their relation to the spaces in or about which they move; not only so, but in organic compounds a mere change of position of a radical profoundly alters the properties of the compound and leads to manifold changes of function.

Often moreover these changes, as in the cases of Immunity and Susceptibility, do not vary gradually but by leaps and bounds, as musical flames respond to scales of vibration. Thus great diversities, contrasts, and strange conjunctions of morbid phenomena do not necessarily signify great divergence of nature in the morbific agents; so that again we cannot get very far by grouping phenomena by direct observation. Processes outwardly disparate may be alike at the core. A small and latent change of chemical constitution may turn a benignant into a virulent substance, and conversely; as we may see in such substances as cacodylic acid and the cyanides; or as saliva, serpent's poison, and trypsin, and so forth. On a small deviation in a secretion we may be destroyed by those of our own household.

How far are hormones a particular category, how far universals? Do they differ in nature from other secretions, enzymes, antisubstances, and so on? Do they by their interactions, compensations, and inhibitions cover the ground of concerted chemical action in kind, as the nervous system does in time; or are they few and peculiar to certain limited needs? Whether inhibitory or stimulatory may often depend rather upon the term of the series to which the hormone is applied than to a difference in quality. Merely to glance at such questions as these reveals to us how vast is the realm of knowledge yet unconquered, nay undiscovered.

> . . . mazes intricate,
> Eccentric, intervolved, yet regular
> Then most when most irregular they seem.

A very interesting transition from physics to chemical biology is found in the phenomena of catalysis. By some elusive property certain inorganic substances—spongy platinum for example, or manganese dioxide—themselves unaltered, exercise an accelerating influence upon chemical change; properties which to-day in industrial processes are utilised on an enormous scale. Now, by our increasing knowledge of biochemistry, we perceive that the function of which the inorganic catalyst is a simple case, is manifested also in more complex orders by certain enzymes, or colloidal catalysts, upon which depend in great part the orbits of our health and of our diseases. In these enzymes which accelerate metabolism we may admire again, as in the simpler catalysts, the exquisite economy of energy in vital processes: how small the energy transactions may be, and these often reversible, which may compass great ends. A striking example of such economy is now being demonstrated to us in the calculated balances of voluntary muscular activity.

To illustrate the bearing of biochemical research upon practical work let us consider the value of what I may call for short "Ambard's constant," of which few practitioners seem to be aware; namely the standard of non-protein nitrogen in the blood. Yet here is an instance of laboratory work of immediate practical importance. Recently I had in hospital two elderly men suffering from prostatic retention and vesico-renal strain of degrees clinically inappreciable. Mr. Sidney Cole estimated for me the degrees of this non-protein nitrogen, and, taking the normal as about 50, in one of them the amount was 224, in the other 227. One of them had already undergone excision of the prostate, and as regards the operation successfully; but soon afterwards the man became uraemic and died. In the other case operation was of course declined; the man was sent home instructed in the use of the catheter, and for treatment of his renal condition.

The balance of hydrogen and hydroxyl ions in the blood, which, as in diabetes, may be a coefficient of many obscure and perilous symptom groups, and other conditions of ionisation, such as modifications of secretion and enzymic action, of the heart-beat, of the constitution of the blood and so forth, belong to subjects now so well known as to need but an allusion ; yet all this subject is again one not of direct observation but of profound physico-chemical research.

The economy of energy is nowhere more manifest than in the universal system of inhibitions ; from the moment that a second field of energy is added to the first interferences occur, and inhibitions are established. Thus—to take a familiar example—thermotaxis is steadiest in man, though in him still tidal ; is less steady in the child, as we see in the remittent type of its fevers, and so downwards to animals endowed with no thermotaxy.

Thus we shall work on Aristotle's double track, the track of the one into the many and of the many into the one ; and on the Heraclitean paths ἐς ἄνω and ἐς κάτω. Permanent inhibitions are no doubt static and established in structure, but this need not be true, and probably is not true, of all inhibitions. Transitory inhibitions are probably occurring continually, both in health and under infections, and may be due to condensations on surfaces, temporary solutions, ionic conversions, hormones, and so on.

Diet and Nutrition.—Diet we shall say is surely a matter of observation and experience ; on diet physicians have written, and written well, from and before the time of Hippocrates. Furthermore, during the last half-century the subject of dietetics has been strictly analysed on quantitative lines, and its energies calculated in caloric and other units. Yet even herein our attainment is far from complete. About this well-worn, almost hackneyed subject a breeze of new and far-reaching ideas is gathering. Our balances, as in the children's milk, and in the analysis of the diseases of deficiency, are eluded by imponderables, by the infinitely little ; our quantities are set at naught. For health and disease the new vitamines, like some other hormonic and enzymic imponderables, are as potent as they are intangible. Hormones work in infinitesimal ranks ; and I believe no antibody has as yet been isolated. Once more we find that Nature laughs at our formal categories, at our several compartments of protein as such, of carbohydrates as such ; a straitlaced reckoning. No one class of foods, it appears, will build or burn without another; carbohydrate metabolism leans on the protein, the protein on carbohydrates, and all these on the fats, in mutual function; each of them is engaged in the totality of the chemical changes. For instance, deficient carbohydrate means deficient oxygenation of fats, and imperfect protein distribution.

Nor is this all; some of our great ancestors, likewise having penetrating ideas of the infinitely little, supposed that the sources of nutrition must contain a supply to each living tissue of its own form of minute identical elements; be it of bone, of muscle, of blood, of "nerve," and so forth; each being proper to its peculiar tissue, to which it attaches itself (Homoeomerism). This crude notion, it is true, made no great way; still until lately we have all of us supposed some, if a more general, congruity of form between the nutritive elements and the qualities of their various destinations. But the study of the reduction of foods to amino-acids, and issues of like researches, are telling us to-day that there is no necessity for the food proteins to be even of similar constitution to the tissues which they subserve. To the almost magical part played by certain elements, such as calcium, as stabilisers, or of the alkali-metals as labilisers of equilibrium I need but allude. The bearing of these dietetic researches upon practice, for example in the treatment of diabetes, are too obvious for reiteration.

If we turn now to the cell, as described to us by Virchow, we realise that our knowledge of this tiny microcosm is as yet only beginning. The infinity of extension is not strange to us, for some of it we can see; but the infinity of the universe of the little, which far escapes even our microscopes, does not strike the imagination. Still even of this inward universe and its intense activities, as by present research they emerge into the field of the mathematical physicist, of the spectroscopist, of the radiologist, of the physical chemist, we are beginning to conceive something. Man is no longer the microcosm, it is the cell of which he is built. To our wonder we see that, even within such tiny spheres, some of them filtrable, are multiple systems moving in relative independence of each other; even the glycogen content cannot be disengaged without altering the whole cell system. The cell membrane is formed chiefly perhaps by the physical processes we have considered. Yet puzzling and intricate as these reactions are, they are all-important to the physician; as for instance in the relations of the glomerular epithelium to sugars; its unerring discrimination between substances, even isomeric, in the blood, as between glucose and lactose; or again in the constant and subtle opposition of the normal intestinal epithelium to the entrance of poisonous elements, or foreign proteins, into the vessels and tissues.

SPECIFICITY IN BIOLOGY.—When Professor Nuttall demonstrated to me his first precipitin reactions I wondered at the prevalence, in the labile fields of biology, of a specificity like the static identities of the inorganic; a specificity moreover not in cell structures only but also in their products, and in the animal juices. How far this individuality extends to the cells and saps of plants I do not know; but in animals we see at once how the native juices resent the invasion of an alien, not only of enzymes and colloidal bacterial toxins, but of normal foreign serums. In transfusion of blood from man to man, we find there are four mutually incompatible groups. Even among lice and fleas each species has its specific host. But it seems inconceivable that the body should keep in store an armoury of antisubstances to meet every possible antigen; is there not some more general potential from which the specific response is more or less determined by the peculiarity of the invading material? Thus the use of tobacco, for us only three centuries old, after a while calls forth in the liver an antisubstance to resist it; a slowly gained immunity, it is true, but perhaps not unlike in kind. There is some evidence that antisubstances may adapt themselves to the chemical form of the antigen which calls them forth. It is said that, at any rate in anaphylaxis, there is a margin of mutability or lability—as distinguished from neutralisation or digestion; something, as observed with approximate antigens, short of absolute specific stability. Some suppose a certain adaptability or elasticity, which, while bending to variable stresses, may be consistent with a fixity of specific structure. The almost startling success of a vaccine or serum now and then amid a series of disappointments, indicates however that some close specific correspondence is necessary for success, and must be exacted in our methods. At any rate the closer the correspondence the less the time and dose required. We must "run it fine." In the cells themselves, even in the lowest bacteria, molecular elasticities seem so far defined in direction that specificity is surprisingly stable; although, in such rudimentary forms of life, lability, and even mutation, might have been expected. Indeed in serology and agglutination we seem to be compelled to steer an exact course between strains of bacteria so akin as the several typhoids, meningococci, coliforms, diphtheroids, and even tetanoids. Yet probably some of these variations are not so individual but that they can have preferential affinities and antagonisms outside their main characters, and show a relative sensibility to various antigens. On the other side of the subject a curious comparison may be made with those species, more obviously of plants, in which, as in the poppy, the foxglove and the calabar bean, antagonistic substances abide together undisturbed.

Moreover there are contingent conditions to be reckoned with, auxiliary or hostile; such as concentrations, ionic reactions, surface actions, and subsidiary co-operative substances. Indeed the effect of a vaccine in saving a patient from a virulent infection is hard to understand; it is hard to see how a man can be saved by instilling yet more of his disease. It may be that the vaccine calls forth a response from the deeps, antisubstances, or co-operative agents, from some remoter regions of the system that the primary infection had not awakened.[1] We are told, that in typhoid fever the vaccine, especially if repeated, calls forth stronger antisubstances than does the primary infection.

Among the gravest of medical problems is this of chronic infections. How far are the conditions which shorten the full span of life implicit; how far due to the effects of poisons working insidiously over many years? Do we die by natural gravitation, or "driven from our orderly spheres"? In this abstruse inquiry laboratory research must go hand in hand with clinical observation. No less urgent is the wide and manifold question of carriers: what in them are the conditions of bacterial survival, and what the means of extirpation of their parasites?

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[1] I leave these words as written, and long in my mind. Sir Almroth Wright has since expressed a similar opinion with an authority and proof to which I cannot pretend. I desire also to express my continual debt to Professor Bayliss.

Immunity and Anaphylaxis.—From specificity we may go forward to the subject of Immunity and Anaphylaxis, one on which I hardly dare address this audience. In this sphere of science and practice throughout the war you have fought with the foremost. I am but a child in this matter. Like a child I was fascinated by the side-chain hypothesis of Ehrlich, which, whatever its ultimate truth, has been at least a scheme welcome in giving some order to swarming facts and ideas. The term antigen may be enlarged to signify any protein, or unknown substance closely bound to protein, which is foreign to the species into which it is introduced. It is said that in the course of a disease anaphylaxis may so intervene as to appear as part of the original malady; that, for instance, certain features in syphilis called parasyphilitic are but anaphylactic. But even here again we may have to deal in considerable part with physical laws; the fixation of complement may be due to adsorption, and a colloidal precipitation at the surfaces of sensitive cells may modify their permeability. Bacterial toxins may all be colloidal; and protein may be inseparable from such antigens as animal extracts. The sudden, often instantaneous, onset of influenza, and likewise, after a long period of dejected convalescence, a release as sudden, suggest that the toxin may not necessarily enter the cell and work its evil therein, but may adhere for a while to the tissue elements, and after a variable interval detach itself. So again the well-known but very remarkable cases of insanity in which intervals of health prove the nervous structures to be unimpaired, suggest adsorption, or temporary alterations of a physical kind in cell permeability. Nevertheless the hereditary element in these cases indicates that in such patients there is a co-operating proclivity, which, however, as probably in the case of pulmonary tuberculosis, may depend upon a local warp of structure. To attribute it to a " soil " is mock knowledge, and perverse at that; soils do not attack but cherish the implanted germ. The no less remarkable alterations of sensitisation and desensitisation may in like manner depend on molecular physics.

With the large, various, and recondite problems of psychology, accentuated and multiplied by the war, it would be impossible within these limits to deal even summarily. But two aspects of the subject I cannot leave unnoticed; the problem of fatigue, and the calculation of individual faculties for particular kinds of work; the proper distribution of the round and the square men. In the field of psychology adaptations are to be ascertained by a method analogous to that of the selection of airmen. Here again laboratory research is laying the foundations for precise knowledge in a sphere which voices of the mist had proclaimed as their own; where they had ruled opinion, and even declared themselves irreducible to law. Reason, it is true, is our last and least organised faculty.

STATISTICS.—The study of Statistics, not long ago the prey of the scoffer, is, under academic methods, such as those of Brownlee and Greenwood, emerging as one of our most potent instruments of practical medicine, both on its prophylactic and on its interpretative side.

COMPARATIVE PATHOLOGY.—I have dwelt upon the isolation of the academic from the clinical worker; but I have to denounce an insularity even more blinding than this: the almost complete lack of any systematic provision for Comparative Pathology. As I urged upon this Association in my Address in Medicine at Glasgow in 1888, and persistently since, in Medicine we are still in the Ptolemaic stage of ideas; we are still anthropocentric. And Veterinary Medicine in its several compartments is still more narrowly confined. Even amongst mankind, research on the ethnology and geography of disease has been but fragmentary; incidental studies with no comprehensive view; and yet with the disturbance and redistribution of peoples the study of racial and regionary pathology is becoming less and less possible.

Do the children of the darker people in towns outlive the fair? and if so why? Are the darker people gaining in numbers upon the fair? We have to learn how diseases vary with the systems of external relations, the conditions of time and place, of season and soil, race and temperament; and this not in higher organisms only, but also in the lower and lowest. Hysteria, for instance, is, or was, rare among our Yorkshire folk.

Again, the facts of heredity in disease, hard to gather in long-living man, are comparatively easy to collect in animals and plants. What is the extra vigour of cross-breeds? Has each strain of pedigree stock its own morbid proclivities, so that we might compare the several series of each kind ?

Yet as the individual is but a link in the chain, so the human chain is a strand in the web of all living things. We must know all disease to understand its several phases. *Nemo alicujus rei naturam in re ipsa feliciter perscrutatur.* " Every class of animals," says Sir John Bland-Sutton, " is distinguished by anatomical details, habits of life and milieu from other groups, differences which involve liabilities to certain diseases, immunity from others. So far as our present knowledge extends we know that certain diseases occur with extreme frequency in one class of animals and are rarely seen in another." We want then natural groups, and groups in natural series, and this means all life. How far have we got in the classification of all disease which, on a natural system, is a measure of our knowledge of it ? Changes which are morbid in man may be normal in lower creatures ; take for example the large sequestrum of the antler of the stag. Why is cancer almost unknown in wild animals, caged or free ? It is said to be unknown among the Esquimos. This cannot be due merely to average age. If atheroma of the great vessels, or of those of the limbs, is rarely found in old horses or cattle, why is it so ? Is it due to special products of catabolism ? Phlebitis is, I believe, rare in animals. What is the relation of the mucin retrogression of myxoedema to the like connective tissue of the fetus, and again to the tissues of certain lower animals ? Is a gouty man a kind of bird ? How large is the field for the study of racial immunities—of the resistance of certain silkworms to the silkworm disease ; of Cochin China fowls to chicken cholera ; of the field mouse to the septicaemia so common in the house mouse (Pasteur) ; of the Algerian sheep to anthrax ; of goats to tubercle ; of dogs to glanders (as contrasted for example with the guinea-pig) ; of Darwin's Florida black pigs to bloodroot, and of the susceptibility of the white pigs to buckwheat ? How curious is the tolerance of rabbits to morphine ! What do we know of rheumatic fever and carditis in animals ? In what respects does a theromorphic heart differ from that of an intrauterine endocarditis ? In the fundamental phenomena of life in animal or plant there is a fundamental unity, and, as in different organisms these are variously ordered, cross-lights are thrown upon their origins and serial distributions. Some animals or races seem more disposed to mesoblastic diseases; others to nervous disorders; and so on. By observing organisms thus in many series we may unravel the constituent parts of the more complex in a way which we cannot do by dissecting these from level to level. As some one wittily remarked, "a minster in decay does not break up into parish churches." But a study of parish churches has thrown a flood of light upon the growth of minsters. Comparative Pathology is needed therefore to indicate steps of development, so that we may not contemplate diseases merely as injury or dilapidation but also as phases of biology. Each advancing stage is longer in building than that below it. Some phases are better studied in lower creatures, even in plants; some better in the more complex.

For the Future?—I have glanced thus rapidly over the field of the medical sciences to reinforce the lesson of their profound and instant bearing upon practice, and the need of linking up the laboratory with the wards. This lesson, this need, I have urged for many years; for instance at the Annual Meeting of the Medical Society of London in 1907 I urged upon the great schools in England the vital importance of establishing professors of Medicine, Surgery, and Gynaecology, as middlemen between the isolated academical worker and the practitioner, between the field of immediate interests and the field of ideas. If I am not a practical man I am nothing; but still I am convinced that only by disinterested research on the large patient and prophetic lines of the pure sciences can progress be made. The isolated academic worker, as well as the practitioner, loses by this isolation; he loses the spontaneous outcrops of problems and crucial instances which so often spring up in practice, but fail to show themselves in the laboratory. So complete and mischievous however has been the barrier between research and the industry of Medicine that a reaction from "laboratorism" to symptomatology has set in, because there are no intermediary workers—no engineers—between the knowledge getters and the knowledge dealers. Thus we see the laboratory investigators completely out of touch with practice, and practitioners faithless of theoretical principles—just "Philistines." A few years ago my own University, or certain influential members of it, discouraged the establishment of a brewing school for which endowments were offered; utterly ignorant and careless as they were that Pasteur's great discoveries began in the wine vat.

There are then three ways in which Principles may be used. They may be taken for granted in a routine dexterity without being understood, as are those of electricity by telephone and electromotor operators and laboratory attendants, in the manner of a blind man tapping with his stick; or they may be fully understood and developed, as by the academician; the third way is that of the technical professor who receives and digests so much of the abstract science as concerns his own industry. Thus as the engineer is something of a mathematician, something of a physicist, so the professor of Medicine must be something of a physicist, something of a biochemist. Through these middlemen the scientist and the practitioner should mutually feed each other. The absence of biochemist and pathologist from the bedside where lies the stuff of their researches, is lamentable. In every adequate clinical school then there must be a *professoriate*; whole time—or nearly whole time—professors, with technical laboratories, biochemical and pathological, who with their assistant staff shall be engaged continually in irrigating our profession from the springs of the pure sciences. From them should radiate what is called an "atmosphere" through the wards; for the professors themselves will be less occupied in teaching the ruck of students; they will gather about them some senior students and all the younger graduates who still frequent the wards. Moreover, I quite agree that for variety of reflection and resources there will still be no less a place than at present for the classes of the Honorary Staff.

GRADUATE SYSTEMS.—Now, in conclusion, this is the true and only factory through which the graduate systems, so much needed and discussed, can thrive and develop. For such reasons I could not see my way to co-operate in any of the narrower schemes of graduate courses to attract men of other countries, and our own. Such a scheme was tried devotedly and most ably by our late dear and brilliant colleague Jonathan Hutchinson; but, being founded on no professoriate, it had no roots; when Hutchinson was gone the scheme dried up: and it will dry up again unless it be an outgrowth of a scientific system, and flourish on the stem of a professoriate and be rooted in the ward and the laboratory. A graduate scheme consisting of desultory side-shows will not continue to draw serious visitors. The visitor wants not cut flowers but a nursery garden. If students are to come to study Medicine in England—for these strictures apply particularly to England—there must be something large and creative for them to come to. Given a professoriate, the special departments of our great hospitals offer a rich soil for the scientific garden, and a larger and more liberal outlook than the islands of the several specialist hospitals. We know in Cambridge how advance is forwarded where laboratories are close neighbours. Science is as intolerant of limits as of dogmas.

It is true that much has been done of late to stimulate and enlighten medical men, the public, and the services concerning the need of systematic pathological investigation; but the mulish aversion from such pursuits, often passing into active animosity, is by no means yet quenched in the national services. Actual discouragement of research work, in some quarters perhaps at home, in many I fear abroad, is still not unknown. Young men, as ardent for knowledge as for their regular duties, find that pathological inquiry, and even laboratory appointments, lead to no promotion, may entail positive sacrifices of pay and other advantages, and sometimes indeed jealous reprisals. As the more antiquated traditions of the services are dispelled things will mend; the sympathetic response of the India Office but the other day to a deputation on this matter promises well for the future: notwithstanding there are yet many dark places in the Empire which need the lantern and the besom. Not only must laboratories be established in all Colonies and Stations—and, let me add, in every English county, a scheme which was provided for by Mr. Lloyd George in the Budget suppressed by the war—but these and their workers must be restored to the full stream of official recognition and reward. It is sad to think of the many men of talent, even of genius, who have been thwarted so long in their devotion to research that the benefits which they could have bestowed upon mankind have been discouraged, maimed, or frittered away.

But now the politician, throwing up his hands, exclaims: What is to be the cost of all these medical developments; academic, laboratorial, professional, prophylactic, and so forth?

We answer, What has been already the cost of *laissez faire*? What was the cost in money, life, and war of the typhoid epidemic in South Africa? And, to come nearer home to the politician, what, for example, is the national cost, well expended we gladly admit, of the profession of the law? To what do the well-earned salaries of lawyers amount, taking those only from—say—£1200 to £5000 a year?—not to mention the still greater offices? The salaries of medical officers of health, including the highest, do not average £800 a year; yet in hours of work, subject matter, professional education, and range of knowledge in daily use, the function of the Medical Officer is surely larger and more exacting than of a Stipendiary Magistrate or County Court Judge. The truth is society has long taken its law, as being the more obvious function, for granted. Robbers came out of the neighbouring forest, but diseases were as God pleased. The depth and powers of medicine the public has yet to learn and realise. Moreover, medical men, innocent angels as they are, have given so freely of their best to the public that for them to look for payment, other than in after-dinner compliments, seems too worldly to be credible.

PALISSY, BACON, AND THE REVIVAL OF NATURAL SCIENCE [1]

CHRISTENDOM rose as slowly out of the Middle Ages as out of the Dark Ages. If in the Dark Ages our fathers had to strive against chaos, ruin, and savage violence, the Middle Ages had to emerge from that stage of iron discipline whereby the nations were consolidated, formed into fighting units, and enabled to work out their several survivals in the new Europe. These disciplines and functions were therefore provisional and temporary; unfortunately the machineries of society, as of manufacture, are apt to outlast the conditions of their establishment, and to petrify into a framework so rigid as to stop further growth. Thus it was with the machinery of the Middle Ages; the means of survival in the day of its development became in later stages a material thraldom and a spiritual despotism. From the Middle Ages however, as from other periods of history, we derive this tribute to ideas; that ideas are stronger than armours of steel; that, in the long run, they are more powerful to govern, and indeed to enthrall, mankind than material systems; and as it was by the irresistible compulsion of ideas that the men of those Ages were first organised into the rudiments and shapes of nations, so by them in after times were men enslaved, times when the ideas which had done their work should have been scrapped, but which in their stony decrepitude were almost impregnable to the boldest assailants. If we admire the power of ideas when they lead us and inspire us, so must we learn also the sinister effects of their shells when, having served their purpose, they oppress and confine us. If we follow them as pillars of fire in the air, so we may fear them when gathering under the earth. If they ride the storm, they drive the volcano. Happily however ideas, these strongest forces of civilisation, are not all on one side; so that by the alliance of some of them we may abate the supremacy of others. Thus, bloody as the conflict was, the rise of Christendom out of the Middle Ages was as slow as it was fitful. Jurisprudence, humanism, universities, printing, science—all these conditions made for free thought; but the *Sturmgeister* and their books were burned, and trimmers preferred obscurity to martyrdom. If on the one side Peter Lombard and St. Thomas Aquinas displaced the Bible, Melanchthon on the other preferred Sacrobusto's *De sphaera mundi* to the *De revolutionibus orbium celestium.* Copernicus himself nursed his ideas in secret till his death-bed; even then Tycho dare not preach them, and Bruno, who did dare it, was sent to the stake. Meanwhile with imprisoned ideas the ground was shaking; and in Italy where, under Pope and Emperor, some sense of unity had grown up, and the need of the iron scaffolding of despotic ideas was felt less than in new and inchoate states of society, attacks on the old by the insurgent ideas were becoming a less perilous warfare—at any rate until the rising of the malignant star of Spain. In Italy for a time nature studies sprang up in some freedom; and in its universities liberal thought and natural knowledge gained some advantage. Medicine, especially on its surgical side, was vindicating the method of progress from facts to facts, as against progressions from words to words. Yet, in all our sympathy with such men as Telesio, Campanella, or Bruno, we cannot but admit that they were rather philosophisers on nature than naturalists; and in the domain of philosophy were less weighty and penetrating than Francis Bacon. Campanella must be regarded rather as the father of modern idealism than as an intellectual comrade of Galileo; his criticism was of phenomena by ideas, not of ideas by phenomena. It was not by the methods of Descartes and Kant that natural sciences were to flourish—not precisely even by the method of Bacon—valuable as these methods were in their own sphere; natural knowledge was to be discovered by humbler devotions, even by digging into the earth, as dug the potter of whom I am to speak to-day.

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[1] Read at the International Historical Congress, April 1913. Reprinted from the *Proceedings of the British Academy*, vol. vi.

Like Gilbert and Galileo, Palissy was led to investigate certain problems of Physics, problems which on account of their comparative generality and simplicity had to be solved before the subtler secrets of chemistry and biology could be tackled. Yet, although as an artist his dramatic life is so familiar to us all as in this place to need no more than the briefest sketch, as a scientific pioneer Palissy is almost unknown. He was born in 1520,[1] in Périgord, as was Montaigne in 1533. The Dordogne had then gone back from English to French; and soon after, under Henry IV., became part of the French kingdom. His native district was an important centre of the art of glass painting, and to this craft Palissy was apprenticed. In 1540 he went to live at Saintes where glass painting still flourished, and flourished for some ten years longer: but after the fashion of his time he wandered widely as an apprentice. We know that he tramped industriously over the Pyrenees and the Netherlands, closely observing the natural features of these countries, and the various works of Nature, especially earths and minerals. Glass painting however was falling into decadence,[2] and while Palissy was striving to make a poor living in a failing art a cup of glazed faience was put into his hands. With the intuition of genius he saw the way to a new craft, could he but penetrate the secret of the pastes and glazes of which the della Robbias, and the craftsmen of Urbino, Faenza, and other *ateliers* tenaciously held the secret. In Palissy's time no pottery was known, at any rate in provincial France, other than the coarse unglazed ware, such as the pipkins, bread-pots and the like, which still existed in the households of the youth of some of us. Now whence came this wonder-working cup? It is said from the East—from China for instance; but we need not make so large a supposition, the source of it was probably much nearer home. The feudal noble of the district of Saintonge was the accomplished Sire de Pons, who married the no less accomplished Anne de Parthenay from the court of Ferrara; and in the very year, 1539, that Palissy saw the "coupe de terre tournée et esmaillée" the Lord of Pons had returned, with many presents, from Ferrara. It is known that Palissy had already attracted the notice of de Pons, and to him it was that Palissy afterwards dedicated his *Discours admirables.* However, hereupon began Palissy's serious researches in two main directions : into the qualities and mixtures of earths, and into the chemistry of glazes. Of this stormy and dramatic period of his life, of the strife of the prescient and tenacious genius against the chiding of his own household and the ridicule of his neighbours, in the depths of poverty selling the furniture of his cottage, and the very coat from his back, to procure the materials of his research, how thus laboriously he discovered lead and tin glazes, the amalgamation and chemistry of earths, and the arts of baking and of modelling which resulted in art products now worth perhaps their weight in gold, is a story familiar to us all. Happily that was given to Palissy which jealous fortune too often denies to the discoverer—the remuneration of toil, and the recognition of his contemporaries. For the once-despised grubber in clay and potsherds became the servant of princes ; and, fervent Huguenot and stubborn naturalist as he was, it was well for him that the Constable Montmorency, and by his mediation the King and Court, took him into their protection ; or the little finger of the Church would have proved stronger than the loins of poverty and distress.

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[1] The date of his birth is not certainly known, but Mr. Tilley tells me 1520 is the most probable date. Also that he is now known to have been born at Agen, in Lot-et-Garonne. He was thus like Montaigne a Gascon, using the name Gascony in its wider sense. (Ref. to R. Weiss, *L'Origine et les derniers jours de B. P.*)

[2] I learn, also from Mr. Tilley, that some decline in artistic merit began about 1550; the substantial decadence did not begin till 1572. The quantity of sixteenth-century glass still existing in France is enormous.

By the patronage of his powerful friends Palissy found his way to Paris, which in the sixteenth century was becoming the most hidebound of European centres of learning : and it is on his work in Paris that I desire to dwell—that is to say, on his scientific work ; in his art-work he is known, and even familiar, to us all.

Palissy, ignoramus as after the standards of Paris he was, yet wrote many books ; books which we may peruse with deep interest. Now these books, discursive as they are, turn but little on the arts of pottery ; nay, the artist may—after the fashion of the times—have deliberately chosen to keep his trade secrets to himself. The books deal chiefly with natural objects in great variety, and reveal his extraordinary personal insight and experience. I have said that his books are discursive ; they are indeed unsystematic, and thus are in striking contrast to the *Summae* of the age. Still, they are not without a natural unity of their own, an organic as contrasted with a logical unity, the unity of a simple and unsophisticated genius engaged in direct and intimate converse with Nature, unwarped by the categories of the schools. The title of his first large book is " Recepte véritable, par laquelle tous les hommes de France pourront apprendre à multiplier et à augmenter leurs thrésors ; composé par maistre Bernard Palissy, ouvrier de terre, et inventeur des rustiques figulines du Roy, et de Monseigneur le duc de Montmorency, pair et connestable de France, demeurant en la ville de Saintes. La Rochelle, de l'imprimerie de Barthélemy Berton, 1563." The first division of the book is on Agriculture, the practice of which, he says—and he was, I suppose, the first modern to say it—can be advanced only by scientific study. He proceeds therefore to investigate the nature and value, I may allow myself even to say, the chemistry, of manures, and especially of marl, as dressing for the land ; and gives advice on their proper applications. Forestry then attracts his notice ; he sees and regrets the evils of deforestation, pleads for an economic management of woodlands, and girds at the devotion of such sources of wealth only to hunting, and like amusements, Next he brings forth the results of his wanderings over the lands of Europe ; he discusses the causes of their outward forms and surfaces, demonstrates the various kinds of earth, the formation of rocks by consolidation from liquid suspension or solution, and the formation of crystals and gems by precipitations and segregations in past ages. He gives a much better definition of a salt than had thitherto been attempted, even by the alchemists. He points out that in a salt two substances combine to form, not a mechanical mixture but a new body ; a unity so close that each constituent gives conditions to the other. He contrasts this regeneration with the phenomena of attraction, phenomena of which again he was no inconsiderable interpreter. Chemical affinity he distinguishes from attraction, as a hidden power of combining to form new substances ; attraction, on the other hand, is often between like bodies without the development of new quality ; and herewith he proceeds to foreshadow a theory of universal attraction and repulsion. He studies also the results of incineration of plants ; and the action of alum as a mordant. With the penetrative insight of genius, he detested the hollowness and unprogressiveness of alchemy ; indeed he tells us that he had worked in the *ateliers* of the alchemists, and that for the most part they were humbugs, and the rest of them altogether foolish. In the veins of the earth he found no evidence that, even by the chemistry of the earth herself, metals were susceptible of transmutation. He declares the search after such chimaeras to be a disgraceful example of covetousness, and of covetousness which would defeat itself; for things are as men use them, a saw which he illustrates by an imaginary controversy between the tools of geometry and of other crafts, the compass domineering over the ruler, and so on; whereas none of these is of the slightest use without the hand of the craftsman. Then he persuades us how far is a flower-bud, with all its wondrous life, above gold and silver; and so passes on to the wonders of the world of plants, and to speculate on the marvellous instincts of animals.

Palissy's books are full of satirical and shrewd humour, as naturally in his moods he drifts from thought to thought in what has been called a *Mosaik-Arbeit*; and not the least of his revelations is that of his own fascinating personality.

Before the Bartholomew Jean Goujon was dead, and Palissy, who had thereupon become necessary to royal splendour, was carried off to Sedan; after the massacre, in which Ramus was deliberately slaughtered, Palissy was brought quietly back to Paris; and in 1580 he published his really astonishing *Discours admirables.* The full title is as follows: "Discours admirables de la nature des eaux et fontaines tant naturelles qu'artificielles, des métaux, des sels et salines, des pierres, des terres, du feu et des émaux. Avec plusieurs autres excellents secrets des choses naturelles; plus Un Traité de la Marne, fort utile et nécessaire pour ceux qui se mellent de l'agriculture, le tout dressé par dialogues Esquels sont introduits la Théorique et la Practique, par Mons. Bernard Palissy Inventeur des rustiques figulines du Roy et de la Royne sa mère. Paris, chez Martin le jeune, à l'enseigne du Serpent, devant le Collége de Cambray, 1580."

Although, in spite of powerful protection, his life was in peril, yet Palissy continued to lecture in public; and it is upon this part of his activity that I desire to dwell; for it is during the years 1575–84 that he exercised his great influence upon society in Paris. At that season his eminence and notoriety must have been as great as the neglect, in part deliberate in part oblivious, to which reactionary influences on the one hand and indifference on the other have since condemned his works and his reputation. For I find it is unknown to men of science and to historians that in this third part of the sixteenth century a great scientific naturalist was lecturing in Paris on agriculture, chemistry, mineralogy, and geology; and this not in an abstract or dryasdust style, but vividly, with demonstrations of the natural objects themselves, which in his lectures he had before him. For Palissy had formed a considerable museum, by means of which his lectures were illustrated, and whereby he endeavoured to draw forth the observing faculties of his hearers. Every object was labelled with the fullest description he could give of it—both as regards its provenance and its nature. In true humility, but perhaps with some irony, he said that he lectured in public in order that one whose education had been so defective as his own might be enriched with more facts and corrected by criticisms. In 1575–76, and again in 1584—not to mention the work of intervening years—Palissy got up a sort of scientific congress in Paris. Into the faces of the learned of his time he thrust his facts; he urged the might of the verified fact, the tests of practical experience, the demonstrations of the senses; and these in a keen and original way. All the world went to wonder at the knowledge of a man without Latin and Greek!

How great and imposing were the audiences at these strange lectures fortunately we know directly from Palissy himself. He gives a long list of the learned and dignified persons who attended them. Physicians, who then were nearer to Nature than other learned men, came in groups, and we have their names. One of them was no less a person than Ambroise Paré, First Surgeon to the King. Two of them, as we might expect, were physicians to the generous Margaret of Navarre. Besides the physicians were many Canons, Jurists, Humanists, Dukes, and others too many to quote. The Museum was always open, and the curator, who now had charge of the royal gardens as Maître Bernard des Tuileries, seems to have been always ready to demonstrate his collections. For, says Palissy proudly, all these persons came to me, and I have challenged them to put me to the test; but I have found none to gainsay me. In the dedication of the *Discours admirables* to the Sire Anthoine de Ponts, Palissy says: "J'ai dressé un cabinet auquel j'ai mis plusieurs choses admirables et monstrueuses, que j'ai tirées de la matrice de la terre, lesquelles rendent tesmoignages certains de ce que je dis, et ne se trouvera homme qui ne soit contraint confesser iceux véritables, apres qu'il aura vu les choses que j'ai préparées en mon cabinet, pour rendre certains tous ceux qui ne voudraient autrement adjuster foi à mes escrits . . . je prouve en plusieurs endroits la théorique de plusieurs philosophes fausse, mesme des plus renommez et plus anciens, comme chacun pourra voir et entendre en moins de deux heures, moyennant qu'il veuille prendre la peine de venir voir mon cabinet, auquel l'on verra des choses merveileuses qui sont mises pour tesmoignage et prouve de mes escrits, attachez par ordre ou par estages avec certains escriteaux audessouz, afin qu'un chacun se puisse instruire soi-mesme : te pouvant assurer (lecteur) qu'en bien peu d'heures, voire dans la premiere journée, tu apprendras plus de philosophie naturelle sur les faits des choses contenues en ce liure, que tu ne saurais apprendre en cinquante ans, en lisant les théoriques et opinions des philosophes anciens."

I cannot undertake to delay you by any attempt to distinguish what may be erroneous from the true teachings of Palissy ; for my principal aim is to impress upon you rather his method than his results. The point is not merely that Palissy declaimed against the schoolmen, but that he built upon another foundation. Nor will I attempt even to make a catalogue of all the subjects on which this industrious and enlightened man discoursed. I will however select a few of these subjects, those which best lend themselves to an illustration of his methods ; of such are his researches on water-springs—in which, by the way, I find nothing about the *baguette*—and his interpretation of the origin of rocks and fossils. In the chapters on Springs and Fountains he illustrates the origin of springs by an artificial hydrostatical machine, or schema, and points out that these waters must come from a height ; if it be not from a neighbouring hill, then from some more distant elevation. By observation and experiment he combated the prevailing notion that springs originated in the percolation of sea-water into the earth, disproving it by the positive method of comparing the substances in solution. He declared, on the contrary, that underground waters accumulate by the permeation of rain through the strata of the earth ; that so long as the strata which receive it are permeable the rain sinks, and sinks until it meets with an impermeable stratum ; then it is arrested, and will be deflected towards a place where the strata crop out. In a note on Virgil's idea of a river, Dr. Warde Fowler (*Class. Rev.*, Dec. 1916) remarks on Lucretius' brief but rational account of a water-system as not so very far from the truth as we know it ; going beyond the " vulgar idea of a river," and touching on "the physical relation of land and water, that would be sure to attract . . . Virgil." How is the ever flowing river to be resupplied with water? How is the balance to be maintained? How does the water get back again? Here Lucretius, though on the verge of truth (v. 261 and vi. 608), goes wrong. He did not know, but probably thought of, an underground system of reservoirs and channels—secret in the earth and vast; and may have regarded them as filled by percolation. See the magnificent scene in *Georgics* iv. 363, and again *Aen.* viii. 66, where by "caput" is meant the whole river, head and system—our "head of water." None since Vitruvius (*temp.* Julius and Aug.) had perceived this truth, and Gassendi probably got it from Palissy, who had shown further how by passing through certain strata water takes up saline and other soluble substances, some of which may have medicinal qualities. The heat of certain springs he attributed to the central heat of the earth. While speaking of rain, Palissy explained that the rainbow is visible when the sun's rays striking upon water-drops are reflected to the observer. Concerning rocks he teaches that many at least of these are formed by deposit of finer or coarser particles from suspension in water, and during long periods of time become gradually consolidated. Da Vinci had made the same observation. Palissy collected fossils widely, and, again as Da Vinci, denounced the absurdity of attributing their origin to Noah's flood or to a freak of Nature; he had convinced himself, and was ready to demonstrate to others, that they could have arisen only from the building of plants and animals; and that if molluscs are found on hills, then those hills were once plains and covered with water; and if the fossils are remains of marine molluscs, then the area which now contains them was once a sea; an open sea or some inlet of the sea. Next he pointed out the contortion of strata, and tried to explain the contours of the earth's surface by the mutations of rock structure. That with the materials at his service it was then impossible to master so vast a subject, and that his opinions were often crude and even erroneous, is little or no detraction from the merit of his method and his extraordinary insight. He demonstrated two kinds of water, that which is free from a stony quality and that which congeals; he names them exhalative and congelative waters respectively, and out of this comparison he is led to a conception of a fifth element, in terms which remind us of the theory of phlogiston. For all early chemists a will-o'-the-wisp inhabited the atmosphere, which in the eighteenth century was caught, examined, and named oxygen. To illustrate the action of "congelative water" he collected a great number of stalactites; and for similar demonstrations he collected petrifactions.

Concerning earthquakes, he says that he had learned more of their nature from a kettle than all the professors had found in the books of the ancients; namely, that they depend on an imprisonment of water which is heated to ebullition in the bowels of the earth. This was the opinion of three other wonderful men, his predecessors, men of whose opinions Palissy had probably never heard; namely, of Aristotle, of Anthemius of Tralles, the architect of S. Sophia, who is said to have tried to prove his hypothesis by imprisoning steam under his neighbour's house, and of Leonardo. Palissy taught that every art, if profoundly studied, has a fullness of science enclosed in it; a truth I have ventured to emphasise more than once against intemperate rebukes of "specialism." "I am," he says, "neither Greek nor Jew, neither poet nor rhetorician; only a simple, humble-minded, ill-educated handicraftsman; but I read in the book of the heavens and the earth more than all the books of the philosophers could tell me." Honesty obliges me not to conceal that at the physicians of his day he deals some shrewd blows; especially condemning their polypharmacy, which he says must be wrong; for none can calculate the effects of commingled ingredients, each of which must modify the action of the rest indefinitely.

But while this Calvinist preacher, this sapper of the Mosaic cosmogony, this scoffer at schools and faculties was making sermons of his insurgent stones, where were the agents of the League? Why, the League was wide awake; not even Catherine—remembering her Florentine love of beauty—and Henry could shield their favourite artist for ever. Other protectors were dead or palsied, so at an age of nearly eighty the old man was thrown into the Bastille; and we have then the not unfamiliar but perhaps apocryphal story of the visit of the king to his old retainer.[1]

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[1] Mr. Tilley tells me that, if the story of Henry's visit be true, it must have been to the prison of S. Germain des Près, where Palissy was first imprisoned; for on May 13, 1588, Henry left Paris, never to return.

Henry, generous as in some aspects of thought and character he may have been, was, as we know but too well of him and of many other potentates, unfit to rise to the height of the needs of the times. These were the words which are said to have fallen from the royal mouth, words at any rate worthy of that monarch : " Mon bonhomme, il y a quarante-cinq ans que vous êtes au service de la Reine ma Mère et de moi ; nous avons enduré que vous ayez vécu en votre Religion parmi les feux et les massacres : maintenant je suis tellement pressé par ceux de Guise et mon peuple, qu'il m'a fallu malgré moi mettre en prison ces deux pauvres femmes et vous ; elles seront brulées demain et vous aussi, si vous ne vous convertissez." Bernard is said to have answered thus : " Sire, le Comte de Maulevrier vint hier de votre part pour promettre la vie à ces deux sœurs si elles voulaient vous donner chacune une nuit. Elles ont répondu qu'encore elles seraient martyres de leur honneur comme de celui de Dieu. Vous m'avez dit plusieurs fois que vous aviez pitié de moi, mais moi j'ai pitié de vous, qui avez prononcé ces mots. 'J'y suis constraint,' ce n'est parler en Roy. Ces filles et moi qui avons part au Royaume des Cieux, nous nous apprendrons ces mots royaux, ce langage royal, que les Guisarts, tout votre peuple, ni vous, ne sauriez contraindre un potier à fléchir les genoux devant des Statues." He is said to have added that to compel him was impossible, for he knew how to die ; but it is not unlikely that at any rate these words of Seneca, " Qui mori scit, cogi nescit," were added to him by later tradition. In the following year Henry fled to Navarre, soon after to meet the retribution his recreancy and debauchery deserved ; and Palissy died a natural death in prison, but a death probably accelerated by enmity, hardship, and neglect.

The enmity of the League, the triumph of reaction after Henry the Fourth, and the jealousy of the University and the Sorbonne took good care that Palissy's methods should be thrust into oblivion. That this was so we learn indirectly from the fate of a work by one Étienne de Claves, Doctor of Medicine, entitled *Paradoxes ou Traités Philosophiques des Pierres et Pierreries, contre l'opinion vulgaire*, Paris, 1635, a book based on the teaching of Palissy ; de Claves was harassed by persecution, and his book publicly destroyed. Thus it has happened that, in spite of some justice done to Palissy by later French writers as an art craftsman, his reputation as a pioneer in natural science lies still in eclipse. Palissy moreover had offended, not the priests and the philosophers only, but also the astrologers and alchemists; and these charlatans did not fail to take their revenge. And there is the less dishonourable cause for the neglect of this great side of his life that Palissy's works as an artist were more popular and attractive than his persistent and original devotion to natural science, which, even in our day, the public might be disposed to set down to the cranks of a curious genius. In 1674 Perrault cursorily noted Palissy's theory of springs; but from that time forward, as a naturalist, Palissy was forgotten till Fontenelle, Jussieu, Buffon, and Cuvier endeavoured to vindicate his due place in history. De Jussieu, 1718, pointed out that, 150 years before, Palissy, of his own wit and observation, had taught of Sicily and of England, that, as they contained marine fossils, they must at some time have been under water. And Buffon said, "a simple potter of the end of the sixteenth century was the first to dare to tell Paris and the Doctors that marine fossils were true animal remains, were deposited in a sea where they now are found, and were born of their respective animal parents. This he defied the Aristotelians to deny." Réaumur offered the same testimony. Yet even to-day these historical facts are almost unknown. In a recent address on the history of geology one of the most distinguished and accomplished living geologists did not even allude to Palissy, the founder of his branch of science. Another very eminent geological professor told me he had never heard of Palissy, except as a potter. It was by the needs of his art that Palissy was obliged to work in earths and minerals; and, endowed with a mind far more powerful than that of ordinary practical men, he brought the vivid insight and the simplicity of genius to the interpretation of their phenomena. Cuvier says of Palissy's observations, "C'est là, comme on voit, le commencement, l'embryon de la géologie moderne . . . la question générale, de savoir comment se sont superposées ces immenses croûtes qui constituent aujourd'hui les parties solides du continent, n'avait pas encore été agitée." Cuvier goes on to say that only by a study of fossils could this problem be solved; and then he proceeds: "Des hommes prétendaient, dans le quinzième et le seizième siècle, que c'était un résultat des jeux de la nature, un produit de ses forces naturelles, des aberrations de sa puissance vivifiante ; Palissy expulsa ces erreurs du domaine de la science." Yet, a few months ago, on entering the University Library, I picked up a volume entitled *Karl Ernst Adolf von Hoff, der Bahnbrecher moderner Geologie*, von Otto Reich, 1905. The author begins, of course, as a good German should, with the Chaldeans ; runs through Greeks and Alexandrians, attacks the Church as the tyrannical suppressor of all science, and then takes us down to Linnaeus and Buffon as the originators of geology. Descartes is mentioned : Steno is mentioned. From his hero, von Hoff, born in the classical shades of Gotha in 1778, he descends the historical stream to Werner and Hutton ; but the name of Palissy is not to be found in the book. Well might Buffon say that Bernard Palissy was a natural investigator so great as Nature only fashions once, yet his teaching had slept for a hundred years. However, strangely enough, the ancients had read some of these signs ; and an interesting comparison might be made between some of his conceptions and those of Da Vinci—who lived a hundred years before him. The ancients, not locked up in the Mosaic cosmogony, had a freer outlook, and were not forbidden to believe their own eyes. Albeit some of their reflections were caprices of fancy to which we, by importing into them our own interpretations, have given factitious values ; as, for example, to the well-known passage of Ovid, in the *Metamorphoses*, where the poet describes a vision of once solid earth become ocean, of lands made into seas, and of marshes turned into sandy desert. Also of shells found upon mountain tops, to which list of fossils however he adds an ancient anchor.[1]

As to Palissy's style, modern readers, besides their surprise at the novelty and variety of his observations, have compared its personal quality even with Montaigne. Cynic however

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[1] Xenophanes of Colophon, the Eleatic (6th c. B.C.) observed fossil plants and animals, of kinds once alive in the sea, yet then far from it; even on the tops of hills far from the sea. Therefore the sea once flowed over them. Some of them were bred of the mud, such as fucoids (read φυκῶν not φωκῶν). I have seen fine examples in the Latomias of Syracuse ; and at Paros and Malta. Of deltas he said earth returned to mud to be *reborn.* (Quoted Ueberweg (i. 58) from Origen, *Philosophia* ; and Hippol. *Adv. haereticos*, i. 14.) An Arab named Kazwini expressed the same opinion in the thirteenth century, and following him Fracastorius (1483–1553) declared that the land and water of West Europe were subject to secular changes of elevation—the land raised and submerged (*Homocentrica*, i. 12). Then came Palissy, Cardan, Caesalpinus, Gesner, Stenson (see Singer, *Ann. Med. Hist.* i. i. Fracastorius).

Palissy is not, nor even sceptic; throughout he is a constructive spirit; but he has the vivid picturesqueness of Montaigne, as best seen in the *Journal of his Travels*; the same shrewd wit, the same spontaneous, free, and humorous apprehensions. His style is seen at its best in his book on pottery, where he describes his strifes with difficulties, and his failures.

Of Palissy's minor writings I may, as illustrations of his grip of facts and lucid intelligence, mention his tracts in denunciation of mithridatics and theriacs; remedies which, gross and foolish as they seem to us, in the sixteenth century had enormous vogue, and even up to the end of the eighteenth were administered by routine in certain hospitals; for instance in Montpellier. It may be that even Paré was much influenced by Palissy; if not initiated into his repudiation of unicorn as an antidote to poison by Palissy, who also exposed its futility, he was supported in it. Palissy also wrote a severe indictment of my own profession, entitled *Les Abus des médecins*;[1] in which I will not seek for naughty words concerning these estimable men; I will rather quote from it another remarkable anticipation of modern scientific theory. He says: "If you were a good philosopher you would know that the elements cannot destroy each other; they can only predominate one over the other according to the conditions of the moment. Water may drive fire away, or fire water; but neither can destroy the other, nor consume it; the elements cannot be diminished nor augmented. If it were otherwise—that the one could consume the other—we should for long enough have been deprived of the due measure of certain elements;" and so on.

It is now time for me to enter upon a most interesting historical problem, namely, of the probable intellectual relation of Palissy to Francis Bacon. I have said that in the years 1575–84 Palissy, having amassed a large collection of objects of natural history, of rocks and minerals, of fossils, and of various earths, and having attached to every specimen a label and description, gave formal lectures with practical demonstrations on these objects, and interpreted them with an acumen and a truth of observation and argument which at that period was without parallel or compare. These lectures, as we have seen, became the fashion, and being delivered by no obscure potter but by a well-known person about the court—namely, Master Bernard of the Tuileries—were attended by large audiences of the first men of the day in Paris. Now we know that in the year 1576 Francis Bacon left Cambridge, disgusted, so the story goes, with the dialectic of the schools, and ready to welcome some new and fruitful method of learning. It is not probable at this time of his youth — Commorant in the University, says Dr. Rawley, at sixteen years of age—that he had conceived what this new and fruitful method should be; but he was yearning for something better than the stereotyped routine of the schoolmen.

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[1] It seems in the light of later researches that the tract entitled *Les Déclarations des abus et ignorances des médecins* is spurious.

Now in this year 1576 it happened that Bacon went to Paris with Sir Amyas Paulet, and there resided for three years, during the first two of which he was attached to the English Embassy, whither all news would find its way. And, in his keenness for new sources of knowledge, Bacon must have heard of these notorious lectures, delivered by a royal officer who was also a Huguenot and reformer, who was challenging all comers to gainsay him, and was loudly proclaiming precisely such a new method as we presume Bacon to have been then in search of. At that date Master Bernard's Museum was the first and only collection of the kind in Europe, and the scheme of its arrangement and labelling was as enlightened as that of the most recent museums of our own day; and far superior to that of fifty years ago—as many of us can personally testify. That Bacon, being in this mind, was not attracted to these curiosities, and to these provocative lectures and demonstrations seems inconceivable. Science or no science, whithersoever the great men of the day went we may be pretty sure that Bacon went also. But, it may be objected, Bacon has said nothing of Palissy or his lectures. Well, directly perhaps not: indirectly perhaps he did. What we do know is [1] that, on the morrow of his return to England, Bacon published a tract entitled *Temporis partus maximus*, a tract unhappily now lost, and from which unluckily we have no definite excerpts. Of its contents we know so little that, but for the allusion to it by Bacon himself in his letter to Fulgenzio, it would have been forgotten. In 1625 Bacon stated that he had published this tract about forty years before. Now forty years before 1625 was 1585; Bacon, as we have seen, returned to England in 1589, and it was about this date that the tract was published. Bacon himself calls it a "juvenile work which with great confidence and a magnificent title I named *The Greatest Birth of Time.*" It seems then to have been a crude and rather turgid—in other words, a youthful—production in which the author, with fresh ardour, proclaimed a new method of attaining knowledge; and this, as we are justified in assuming, was by the collection, observation, interpretation, and proof of natural phenomena and processes. Now, short of demonstration, can any probability be stronger than this—that Bacon, hungering for a more fruitful method than the droning of the schools, during his residence in Paris went to the lectures and inspected the Museum of Palissy, Palissy who was defying the schoolmen as fervently as Bacon himself could have desired, and who was moreover constructing the new method of direct investigation of Nature by facts; that Bacon was fired by this revolutionary teaching, and in the heat of his illumination wrote the immature and vaunting proclamation of the new gospel which afterwards he redigested and developed into the magnificent structure of the Instauration? What is certain is that Palissy was then teaching practically the methods which a few years afterwards Bacon propounded at length; and, not only so, but was teaching them, if with an inferior literary capacity, yet with a sounder grasp of their methods. For is it too paradoxical to say that as Palissy was among the first of the men of science, Bacon was one of the last of the schoolmen? He was still a schoolman in his encyclopaedic conceptions, in the philosophising habit of his mind, in his crude apprehension of methods of natural observation and experiment, and in his incapacity for appreciation of genuine natural research in those of his contemporaries who were not compiling new instaurations but building up the foundation of natural knowledge — such men, for instance, as Harvey and Kepler whom he ignored; Copernicus whom, with his disciple Bruno who on Bacon's return was actually in London, he shirked; Gilbert whom he classed with the alchemists; Galileo whom he attacked. Unfortunately, as Kuno

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[1] I had independently arrived at the facts and opinions set forth in this paper up to this point. For the reference to the *Temporis partus maximus* I am indebted to Hanschmann's *Essay on Bernard Palissy*, Leipzig, 1903. My paper was read to the Eranus Club at Cambridge before Hanschmann's work was published.

Fischer admits, Bacon was no mathematician; now natural science found its first solid foundation in physics, and physics in mathematics.

But, it may be said, surely if Bacon had been so inspired by Palissy he would have mentioned him, and held him in honour. Now it is unnecessary to ask ourselves how far Bacon's intellectual character, so far as we can read it, was that of a man who was likely to pay a generous tribute to any forerunner; or how far his moral character would dispose him to declare himself a disciple of a reformer notoriously under the suspicion of the ruling classes in Paris, and preserved from instant peril only by the personal intervention of Montmorency and the King. Such generosity the history of Bacon's life hardly suggests to us. But it is unnecessary to press these painful questions; it is sufficient to remember that even so late as the sixteenth century plagiarism was unknown as a sin (p. 273), and, by the code then prevailing, literary debts were not even debts of honour. Even the honest and gentle Paré himself did not hesitate to borrow freely from the works of his contemporaries; and when in a particular instance Paré was reminded that he had drawn freely upon the work of his contemporary De Héry, Paré calmly replied that a candle must always be lit at another candle. Bacon makes no mention of Ramus, to whom Professor Jackson thinks he was deeply indebted; that he expresses no debt to Palissy is therefore of little weight in our inquiry into those obligations to forerunners and contemporaries of which not the greatest of men have been independent. To learn what Palissy was actually teaching in Paris during Bacon's residence there, it is necessary only to turn to the full title of the *Discours admirables*, which I have already cited at length. It would be unfair, no doubt, to contrast a contemplative reformer of philosophic methods with a working naturalist like Palissy; and it would be untimely to enter upon a criticism of the validity of Bacon's positions taken as a whole; yet it may be permitted to me to say that however imposing his philosophic system, however impressive in turning men from stereotyped scholastic dogma, yet Palissy—like his contemporary Gilbert, and like Galileo who came very soon after him — was one of the chief engineers of the new paths of knowledge, and was in France the chief engineer. Indeed, astronomy and mathematics apart, he with Dodoens and Gesner was the first in Europe, since Aristotle, Theophrastus and Pliny, to pursue modern scientific methods in the worlds of geology, botany, and zoology, and to work and teach from and with the natural objects themselves.

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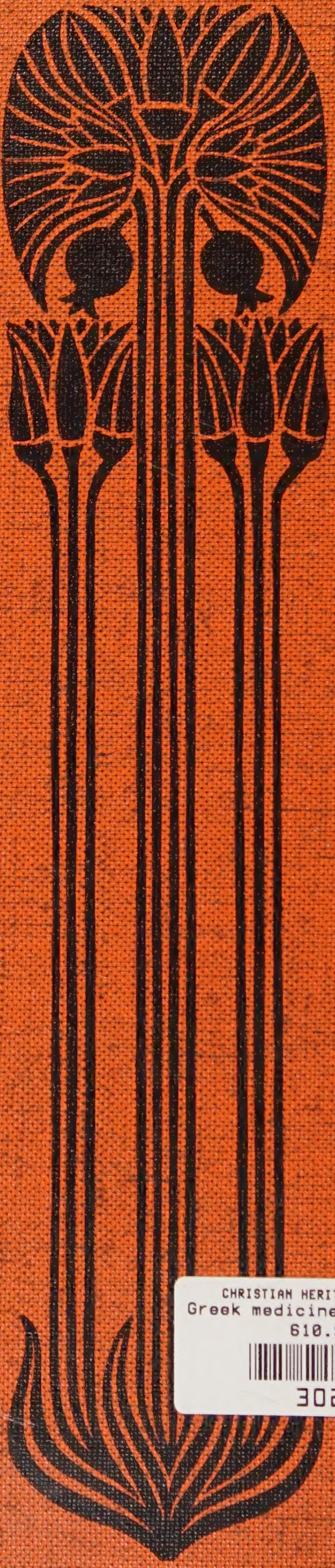

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